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# Bowater's Offers New 5 Per Cent Bond Issue

## Bonds Floated To Finance Expansion of Bowater's Newfoundland Pulp and Paper Mill At Corner Brook—Bonds To Yield 5.13 Per Cent—Present Newsprint Sales Estimated At 156,000 Tons—Forestry Plan Urged.

[FROM OUR REGULAR CORRESPONDENT]

MONTREAL, Que., December 26, 1939—The principal topic of interest in the industry here this week has been supplied by Bowater's Newfoundland Pulp and Paper, which through a Montreal firm of investment security dealers, has offered a new issue of first mortgage 5 per cent bonds. It will be remembered that Bowater's, the famous British firm of newsprint manufacturers, in 1938 took over the expensive newsprint and sulphite plant of the International Power and Paper Company of Newfoundland at Corner Brook, Newfoundland, which, in the opinion of the present management is one of the lowest cost producers of newsprint paper in North America. The issue of bonds now being floated is for the purpose of financing extensions to the company's existing sulphite pulp mill, designed to increase the annual capacity of this mill by 30,000 tons. This is expected to increase materially the earning power of the company. The present capacity of the sulphite mill is 260,000 lbs. per day. The newsprint mill has a capacity of 1,200,000 lbs. per day and the groundwood mill a capacity of 1,000,000 lbs. per day.

### Sales Estimated at 156,000 Tons

It is estimated that for the year ending December 31, 1939, the company's sales of newsprint will approximate 156,000 tons, against 113,199 tons in 1938. Trading profit and miscellaneous income, it is stated, will exceed $2,000,000 against $1,275,394 in 1938.

For the ten months ended October 31, 1939, newsprint sales are shown at 126,694 tons. Trading profit and miscellaneous income for the period was $1,659,425. After bond interest, depreciation, depletion, debenture and other interest, and bond discount and expense, there was a balance of $134,388 which was credited to surplus account, which was thereby increased to $2,054,339.

### Bonds To Yield 5.13 Per Cent

The new bonds, which are being offered at 98 to yield 5.13 per cent, are dated January 1, 1940, are due January 1, 1968, are payable in lawful money of Canada, are callable in whole or in part at 103 per cent to and including January 1, 1946, thereafter at ¼ of 1 per cent less for each succeeding six-year period and at 100 from 1964 to 1968. The sinking fund will be calculated to retire $1,875,000 of the $2,500,000 of bonds now being issued.

A two-day conference of the Province of Quebec Forestry Engineers, held last week, gave considerable study to the topic "The Forest and the Social and Economic Problem," and as a result adopted a resolution urging the organization of sylvicultural works along the lines of those performed by the Civilian Conservation Corps of the United States and the Canadian National Forestry plan, not only to improve private property but also to better the value of the wooded sections of the state.

Among other things, delegates urged education of the farmer in ways and means of withdrawing the most profit from his land and forest.

## Concerned About Newsprint Exports

[FROM OUR REGULAR CORRESPONDENT]

VANCOUVER, B. C., December 26, 1939—Doubt exists as to the future of the British Columbia exports of newsprint to Australia with the decision of the Commonwealth Government to reduce its purchases in non-sterling countries. For long the Government has sought to secure a more equal trade balance with Canada, which has always had much the best of the deal.

The Pacific Mills Ltd. at Ocean Falls, B. C., and the Powell River Company at Powell River, B. C., are sharers with eastern Canadian mills in a long term contract for supply of newsprint which was negotiated with Australian publishers two years ago. This, however, is subject to Government approval.

These two British Columbia plants sold about two million dollars worth of newsprint to Australia in the past year, and had hoped to step this up in 1940 when competition of Baltic countries was eliminated.

The problem for the Australian publishers, however, will be whether to force their government to permit imports of Canadian newsprint or else reduce the size of their papers, as they will have very grave difficulties under present war conditions in finding a source of supply outside the Canadian mills.

## Wheels Turn at Southland Paper Mills

Wheels were turned for the first time last week at the plant of the Southland Paper Mills, Inc., which are to produce newsprint from Southern pine at Lufkin, Tex. While only the grinders are in actual operation at this time, the production of newsprint on a commercial scale will be started as soon as possible. However, owing to the many readjustments that must be made under pioneering conditions, it cannot be stated at this time just when this will be.

# Ahdawagam Paper Co. Completes Addition

## Building Providing 67,000 Square Feet Added To Plant of Ahdawagam Paper Products Co. and New Equipment Will Be Installed Soon—Problem of Diminishing Timber Supply — Milwaukee Lace Paper Expands.

[FROM OUR REGULAR CORRESPONDENT]

APPLETON, Wis., December 26, 1939—Construction has been completed by Ahdawagam Paper Products Company, Wisconsin Rapids, Wis., on its factory addition. The entire project was accomplished within approximately four months under the direction of Tom Utegaard, engineer of the Consolidated Water Power and Paper Company, and George Marcoux, construction superintendent of Consolidated.

The building is of concrete and steel, 242 by 282 feet in size, providing 67,000 square feet of added manufacturing, shipping, storage and office space. It has 6,000 square feet of window lights. The walls are being sprayed with white enamel for added lighting effect.

Installation of machinery for cutting, counting and packing of paper will be installed immediately, and operations are scheduled to start in addition shortly after the first of the year. Frank Walsh is manager of the company.

### Consider Problem of Decreasing Timber Supply

Broad, constructive legislation will be proposed at the coming session of Congress to meet the problem of dwindling timber supply in the Middle West. This was assured by Representative Hampton P. Fulmer of South Carolina, who served as acting chairman in the absence of Senator John A. Bankhead of Alabama, on the congressional committee which conducted two days of hearings at Madison, Wis., last week. Other members of the committee present were Representative Daniel A. Reed of New York, and Representative Walter M. Pierce of Oregon. Ten states were represented, and the opinions of forty persons were expressed. The committee was appointed by President Roosevelt to make a study of forestry in all part of the country. Other hearings have been held at Utica, N. Y., Mobile, Ala., San Francisco, Calif., and Portland, Ore.

Samuel T. Dana, dean of the college of forestry and conservation at the University of Michigan, recommended state action to restrict private logging, with use of police powers to safeguard the public interest. He also recommended an immediate program for adequate protection of forest lands from fire, insects and disease, and methods of systematic planning.

M. W. Torkelson, state planning director for Wisconsin, told the committee reforestation was vitally needed to protect employment and aid farmers operating on submarginal land.

Allocating more of the agricultural and forestry appropriations for basic research in forest products was urged by Robert B. Goodman of Marinette, Wis., former chairman of the Wisconsin Conservation Commission and a director of the Northern Paper Mills, Green Bay, Wis.

"When you review the work of the forest products laboratory of the forest service," said Mr. Goodman, "I urge you to bear in mind that this work concerns the ultimate usefulness of one-fourth of our nation's area, that it relates directly to the problem of unemployment, that it concerns the market for the farm woodlot crop, and that it is necessary to bring about self-liquidation of public and private expenditures in forestry. This basic research lays the foundation for better wood conversion processes, for the improvement of present wood uses, and the discovery of new uses through which forests may increasingly contribute to our national self-sufficiency, and our national economy."

### Further Forestry Legislation Opposed

Further forestry legislation was opposed by Prof. Clarence P. Manion of the University of Notre Dame law school, who refuted arguments that government acquisition of forests increased local costs. He said there are sufficient laws on the books now if enforced properly. It is found, he added, that local government costs are reduced $10 for every dollar spent for acquisition by the federal government, he said.

Minnesota and South Dakota officials suggested that the national government pay states and local communities an acreage tax or some other form of aid on their forest areas. Making the rural schools an integral part of any such program, and designating the appropriations as educational aids was proposed for counties where the small percentage of area not used for forests provided inadequate local taxes.

Research accomplishments of the United States Forest Products Laboratory, Madison, Wis., were reviewed by C. P. Winslow, director, who said that southern pine had been found practical for newsprint, writing and wrapping papers.

Congressmen Stephen Bolles, Wisconsin, and Frank Hook, Michigan, made recommendations and promised support of remedial legislation. Numerous others expressed their views. The committee will discuss its findings with heads of the United States Department of Agriculture, of which the forestry service is a branch, and will make recommendations to Congress and President Roosevelt on or before April 1, 1940.

### Lace Paper Co. Builds New Machines

Several additional machines are being built by the Milwaukee Lace Paper Company, Milwaukee, Wis., to turn out new patterns and increase production. The company is now producing more than 500 items of doilies, dinner sets, candy box laces and other such products. All of the steel dies are made by the company's own skilled engravers. The partners, C. W. Hamilton, president, R. N. Hamilton, vice-president, and K. C. Hamilton, secretary, are constantly seeking new designs in lace to be reproduced for the trade. Operations are carried on in a six-story building built in 1912. Since then the company acquired a nine-story building used for shipping and warehouse facilities. The business was started by C. W. Hamilton

in 1898 in a small backroom shop and has grown to a leading position in the entire industry.

### Nekoosa-Edwards Salesmen Meet

Thirty sales representatives of the Nekoosa-Edwards Paper Company held their sixth annual sales conference last week at the company's offices at Port Edwards, Wis. Promotional plans for the coming year were discussed with officials and department heads. The gathering included a luncheon at the Port Edwards hotel at which Dr. Silas Evans, president of Ripon College, Ripon, Wis., was the speaker.

### F. J. Sensenbrenner Celebrates 75th Birthday

F. J. Sensenbrenner, president of Kimberly-Clark Corporation, Neenah, Wis., celebrated his seventy-fifth birthday anniversary this month. The occasion was commemorated by a dinner given by Mr. and Mrs. John S. Sensenbrenner Saturday evening, December 23, at the North Shore Country Club. Last year the executive committee of the company tendered him a dinner upon completion of his fiftieth anniversary with the Kimberly-Clark organization.

### S. W. Mead Selected Chairman By Scouts

Stanton W. Mead, treasurer and general manager of the Consolidated Water Power and Paper Company, Wisconsin Rapids, Wis., has been chosen as chairman of Samoset Council, Wood County, of the Boy Scouts of America.

### Walter Gresens Named to Traffic Committee

Walter Gresens of the Tuttle Press Company, Appleton, Wis., has been named to the executive committee of the Fox River Valley Traffic club, representing industry. The club held a dinner last week at Hotel Athearn at Oshkosh, Wis.

## The Dictionary of Paper

Paper, like food and clothing, is a commodity which affects the daily life of nearly every individual. His morning news is printed on paper, his food is wrapped or packaged in paper or board, his clothing requires paper in its manufacture and sale and may even be a derivative of pulp, the raw material for paper. Yet, with all these common uses, comparatively few people know what paper is and still fewer know of the hundreds of types of paper which are used for thousands of purposes. From time to time efforts have been made to define the various kinds of paper. Thus in 1924 and 1928, the National Bureau of Standards, with the cooperation of the American Paper and Pulp Association, compiled the book, "Classification and Definitions of Paper", which was published by the Lockwood Trade Journal Company. This was a step in the right direction, but unfortunately it was the work of only a few individuals and did not represent a cross section of the paper industry. Still more recently Labarre published his "Dictionary of Paper and Paper Terms," but he was apparently more interested in the origin and historical proof of the meaning of technical words than in their practical significance.

Recognizing the need for a suitable dictionary which would be of real value to both the manufacturer and the consumer of paper, the American Paper and Pulp Association three years ago set up a Committee on Classification, Definition, and Grading of Paper under its Technical Committee and selected twelve outstanding men, each of whom had a specialized knowledge of some particular field of the industry. Realizing that these men could not give sufficient time to the task, the Association delegated to The Institute of Paper Chemistry the job of correlating, supplementing, and editing the material supplied by the Committee.

It was necessary, as a first step in the program, to evolve a philosophy of definition. This led to the conclusion that a definition should include, as far as possible, a statement regarding the use of the paper, the raw material and manufacturing conditions employed, and special properties which distinguish one paper from another. Obviously, it was found impossible to secure these data for all papers but the ideal definition was always in mind. Furthermore, it was deemed desirable to define the terms used in describing a paper and also other terms in common use by the industry. Printing consumes a considerable tonnage of paper and therefore brief descriptions of printing processes were added.

The Committee early realized that, if the book was to reflect the present state of the industry, it was necessary to secure the cooperation of technical men, plant managers, and others having specialized knowledge; the response was practically unanimous and this assistance on the part of more than five hundred individuals and mill organizations has made it possible to present a large amount of information which has never before appeared in print.

"The Dictionary of Paper" consists of four chapters—The Philosophy of Definition; Classification and Definitions of Pulps; Classification of Waste Materials used by the Paper and Board Industries (which also contain definitions of waste papers used by book mills, assembled for the first time); and Definitions of Papers, Boards, and Papermaking Terms. The last chapter contains more than 3500 definitions, most of which have been written by men who are familiar with the products or terms in question.

These definitions have not only been reviewed repeatedly by the Committee, but also have been critically scrutinized by the Trade Associations, each Association covering those products which fall within its jurisdiction; their cooperation has not only improved the definitions but has added new products and terms. Printing terms were edited by experts in this field.

It is believed that this work will prove of value to all who are engaged in the manufacture, conversion, sale, and use of paper.

This book is now in the process of manufacture and will be ready for delivery about March 1, 1940. The American Paper and Pulp Association is offering a special prepublication price of $4.00 until February 1, 1940, for the details of which see their advertisement in this issue.

## Sidney Roofing Co. Builds Warehouse

[FROM OUR REGULAR CORRESPONDENT]

VANCOUVER, B. C., December 26, 1939—Erection of a new storage warehouse is now in progress at Victoria, B. C., for the Sidney Roofing and Paper Company. The new unit will adjoin the existing main plant of the company at 47 Songhees Road, and will cost about $15,000. It will be one story in height and 50 by 150 feet, with steam heating plant.

# Newly Formed Company May Erect Pulp Mill

## Transcontinental Timber Co. of Toronto With $1,000,000 Capital, Owning 895 Square Miles of Timber Lands, May Erect 200 Ton Pulp Mill At Mattice — More Interest In Paper Securities — Other Industrial News.

[FROM OUR REGULAR CORRESPONDENT]

TORONTO, Ont., December 26, 1939—A provincial charter has just been granted to Transcontinental Timber Company, Limited, with headquarters in Toronto, and an authorized capital of one million dollars. Brig.-Gen. D. M. Hogarth is one of the principals in the organization and Wallace Delahaye, who for a number of years was identified with the Canadian International Paper Company in the Gatineau district, is operating manager of the new company which owns 890 square miles of freehold timberland in the Cochrane district not far from Hearst. The timber is along the Missanabie River and the Shekak River and consists chiefly of spruce, with a scattering of hardwood and hemlock.

It is understood that the Transcontinental Timber Company has several plans in view for the development of their timber limits, among them being the erection of a 200 ton chemical pulp plant at Mattice, which is 20 miles east of Hearst and 40 miles west of Papuskasing. There are two railroads running through the holdings of the Transcontinental Timber Company; the Algoma Central and the Transcontinental road.

According to present expectations, construction of the chemical pulp plant will begin early in the summer, and it is understood that the product has already been contracted for by a number of American mills and converting plants. The offices of the new company are located on the 31st floor of the Canadian Bank of Commerce Building, King St., W., Toronto.

### Provincial Paying Farmers $1,000,000

At its present rate of operation, Provincial Paper, Limited, Port Arthur, is distributing a million dollars a year in wages and in payment for wood to farmers. There are 425 men working steadily in the mill, and they receive $650,000 every year. In Provincial camps on the Wolf River and the Black Sturgeon, 350 more men will earn $210,000. Although the normal requirements of the mill are 65,000 cords of wood a year, this season will see about 45,000 cords cut in the company camps and another 25,000 cords bought from settlers.

Experiments conducted in the last few years have resulted in an increasing use of poplar in making certain grades of paper. Although the wood is used only as a filler, not giving the strength of spruce, as much as 25 per cent poplar is used in certain grades of magazine paper. Being cheaper than spruce, its use cuts costs of production. Probably 40,000 cords of poplar now is cut in the district for use in pulp making, either in the district or for export to the United States, A. G. Pounsford, manager, estimated.

### Interest in Paper Securities Increasing

Speculative interest in paper securities has been increasing, owing to the consistent appreciation in the bonds of this group in recent days. Reports from companies on this year's business results are a constructive factor. Abitibi Power and Paper Company's November net earnings available for depreciation and interest increased 71.12 per cent, over the like period a year ago, and various other companies have reported a sharp step up in operations and earnings. While newsprint remains at the higher price established at the beginning of 1938, other products produced have advanced in price, making for dual benefits. The gain in Abitibi's November earnings of $248,069, was due to the extent of $144,826 to the premium on United States funds. This is found money, and it is expected that it will continue to accrue to Canadian companies as long as the war endures. The year 1940 looks better, because shipments to the United States from European sources are expected to be much more severely curtailed.

### Great Lakes Production at 67 Per Cent

Production of Great Lakes Paper Company, Limited, Fort William, Ont., for the year ending December 31 next should average approximately 67 per cent of rated capacity of 113,100 tons, it is stated in authoritative quarters. This would be about 2 per cent below the average of the industry as a whole.

Some improvement in earnings in 1939 is looked for over the $134,491 or 67c per share on the preferred earned in year ended Dec. 31, 1939, and judging from present conditions within the industry greater improvement may be anticipated in 1940, it is stated.

The company is receiving better prices for its unbleached sulphite, capacity of which is being increased from 15,000 to 24,000 tons annually over and above its own requirements for newsprint.

The company's contracts are in satisfactory shape, and the Milwaukee Journal contract which was reallocated to other Canadian producers for 1939 will be handled by the company again in 1940.

### New Minnesota & Ontario Bonds Proposed

Now that court hearings on reorganization of Minnesota and Ontario Paper Company, have been completed and interested parties will be given until January 2, 1940, to submit pertinent suggestions in writing to the court, a get-together of the several groups is expected. In local circles it is claimed that differences separating the groups have been narrowed considerably and that a generally acceptable scheme should not be difficult.

The main point at issue concerns the rate of interest on the proposed new issue of first mortgage bonds. Trustees have recommended that the new issue carry a four per cent coupon whereas bondholders feel rate should be five per cent. Both groups are agreed that 50 per cent of principal bonded indebtedness should be compensated for with this issue. If the five per cent rate were effected bondholders say they would be content with 30 new common shares instead of the 40 new shares provided for in the trustees' amended plan.

# Chicago Considers Trade Prospect Good

## Midwest Paper Trade Reports Seasonal Slowing Up of Trade But Views Future Outlook As Favorable—Coarse Paper Merchants May Form Association—City Delays Adoption of Paper Milk Containers — Other News.

[FROM OUR REGULAR CORRESPONDENT]

CHICAGO, Ill., December 26, 1939—The local paper trade slowed up materially in the past week but the market in general got a great deal of satisfaction out of the active retail buying in the Chicago area. Likewise, there persisted the unanimous feeling that after the first of the year consumption of the marked upturn of a few weeks ago would be in evidence. All lines were reported as comparatively quiet during the past week but both jobbers and mill representatives were waiting until after inventory periods to encounter further briskness. Waste papers continued strong in the local market. In the general paper lines, books and covers were fairly active; groundwoods reported many inquiries and newsprint activity was also general. Sulphite bonds were steady to strong though demand was comparatively slow. Krafts were in good demand with inquiries for 1939 quite numerous and indicative of general worries over the raw material situation in 1940.

### May Form New Paper Trade Association

Realizing the need for unanimity of opinion and action, coarse paper merchants in this area are reported to be contemplating the formation of a new Chicago Paper Trade Association to take the place of the old organization which ceased to exist this Fall. Several prominent merchants met in Chicago about the middle of December to confer with R. H. Zeigler, assistant secretary of the National Paper Trade Association, who presented them with an outline of a program of work. Further meetings are to be held early in 1940 in the hope that an affiliate member of the National Paper Trade Association may be set up in Chicago at the earliest possible moment.

### Hopper Paper Co. Installs Air-Conditioning

The Perfecting Service Corporation recently installed a thoroughly air conditioned finishing room for the Hopper Paper Company of Taylorville. Equipment came from the Carrier Corporation, equipment which will make it possible for the progressive mill to sheet, inspect, trim and pack paper ready for shipment in atmospheric conditions the same as those of the printing plant which will ultimately receive the shipments. The controls make it possible to duplicate any printing room condition between temperatures of 70 degrees Fahrenheit and 85 degrees Fahrenheit. Any specified changes in the ranges for both temperatures and humidity may be secured within twenty minutes and maintained for a satisfactory period of time.

### Delay Use of Paper Milk Containers

Chicago interests anxious to sell milk in paper containers in this area are beginning to doubt that the city will ever voluntarily amend the milk ordinance to permit such action. This week, after four years of litigation and at least six months of very intensive action, the Fieldcrest Dairies filed a 200 page printed brief setting forth the dairy company's attack on the present ordinance as discriminatory and unreasonable. The plaintiff feels that it will get no action from the city and must get it from legal action. The brief said that the city made no effort to test paper containers or learn their merits until after the suit was filed and reminded the federal court that paper cartons are permitted in 70 suburbs in the Chicago area. The brief also contained an attack on the testimony of Dr. Lloyd Arnold, member of the board of health, who once wrote a report favorable to the cartons and has since consistently opposed them as a member of the health board. It is reported that labor groups have objected to the paper containers because of decreasing the amount of work available for delivery drivers, it being possible for trucks to carry more milk in paper cartons than in glass bottles. Proponents of the cartons continue to stress their convenience and economy. At the present time, the Fieldcrest opinion is before master in chancery J. I. Grossman who has indicated that in due time he will refer his findings to Federal Judge Charles E. Woodward for ultimate decision.

### N.P.T.A. Confers with Chicago Members

The National Paper Trade Association recently held a conference in Chicago with representatives of local associations and member firms on hand to discuss problems pertinent to the paper trade. A survey was presented through the statistical research division of the Association which gave a most interesting insight into methods of compensation for outside salesmen. R. H. Ziegler, assistant secretary of the N.P.T.A., was present and remained to hold further discussions with coarse paper merchants of the city.

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## Netherlands Paper Industry

MONTREAL, Que., December 11, 1939—That the pulp and paper industry of Holland will be seriously dislocated in the event of prolonged hostilities, and that while Canadian producers of pulpwood, pulp and newsprint cannot be expected to replace at short notice the Scandinavian, Soviet Russia and German shipments, they should be able to substantially increase their exports to Holland, are opinions expressed by J. A. Langley, Canadian commercial attache at Rotterdam. He says despite the fact that the Netherlands paper industry is one of the oldest in the country, Holland is an important market for foreign newsprint and other types of paper. In 1938 the domestic production of newsprint was 88,280 tons, of wrapping paper 76,785 tons, and of wood free, hard sized printing and writing paper 42,855 tons. The aggregate production of paper represented a value of more than 37,789,000 guilders. Annual exports amount to about 46,100 tons, whereas imports are estimated at 79,500 tons. Mr. Langley

# Financial News of Pulp and Paper Industry

Dexter May Obtain Loan—Increased Earnings For Abitibi and Marathon—Bird & Son and Price Bros. Declare Dividend — Scott Paper Co. and American Paper Goods Give Bonuses—List A. P. W. Paper Shares.

**New York Stock Exchange**

High, Low and Last for the Week Ending December 27, 1939

| | High | Low | Last |
|---|---|---|---|
| A. P. W. | 3¾ | 2¾ | 3⅝ |
| Armstrong Cork Co. | 37⅝ | 36⅞ | 36⅞ |
| Celotex Corp. | 10¼ | 9¾ | 9¾ |
| Celotex Corp., pf. | 62½ | 61½ | 62½ |
| Certain-Teed Products Corp. | 6½ | 6⅜ | 6⅜ |
| Certain-Teed Products Corp., pf. | 30½ | 28¾ | 29 |
| Champion Paper & Fibre Co. | 25½ | 25 | 25¼ |
| Champion Paper & Fibre Co., pf. | 100 | 100 | 100 |
| Congoleum-Nairn Co. | 22⅞ | 21⅞ | 22⅞ |
| Container Corp. of America | 16⅝ | 16 | 16⅛ |
| Continental-Diamond Fibre Co. | 7 | 6½ | 7 |
| Crown-Zellerbach Co. | 17⅝ | 16¾ | 16¾ |
| Crown-Zellerbach Co., pf. | 92⅞ | 91 | 91 |
| Flintkote Co. | 20½ | 19⅜ | 19⅝ |
| Robert Gair | 3⅞ | 3⅝ | 3⅝ |
| Robert Gair, pf. | 16¼ | 14¼ | 14½ |
| International Paper & Power | 14⅛ | 13½ | 13½ |
| International Paper & Power, pf. | 57⅜ | 53¼ | 54 |
| Johns-Manville Corp. | 75½ | 73½ | 73¾ |
| Johns-Manville Corp., pf. | 129 | 128 | 128 |
| Kimberly Clark Corp. | 37 | 36 | 36 |
| MacAndrews & Forbes | 34 | 32½ | 33⅝ |
| Masonite Corp. | 38⅝ | 36¾ | 36¾ |
| Mead Corp. | 11½ | 10⅜ | 10⅜ |
| Mead Corp., pf. | 61 | 61 | 61 |
| Paraffine Companies, Inc. | 44 | 40½ | 40½ |
| Paraffine Companies, Inc., pf. | 100 | 100 | 100 |
| Rayonier, Inc. | 17⅜ | 17 | 17¼ |
| Rayonier, Inc., pf. | 28⅜ | 28 | 28⅜ |
| Ruberoid Co. | 18½ | 17½ | 17½ |
| Scott Paper Co. | 47½ | 47⅛ | 47½ |
| Sutherland Paper Co. | 29 | 28½ | 28½ |
| Union Bag & Paper Corp. | 13⅛ | 12½ | 12½ |
| United Paperboard Co. | 5¾ | 4¾ | 4¾ |
| U. S. Gypsum Co. | 87½ | 83 | 83 |

**New York Curb Exchange**

High, Low and Last for the Week Ending December 27, 1939

| | High | Low | Last |
|---|---|---|---|
| American Box Board Co. | 7½ | 6¼ | 6¼ |
| Brown Co., pf. | 28 | 25½ | 27¼ |
| Great Northern Paper | 44 | 43¾ | 44 |
| St. Regis Paper Co. | 3¼ | 2⅜ | 2¾ |
| Taggart Corp. | 6 | 5⅜ | 5⅜ |

## Loan for Dexter

[FROM OUR REGULAR CORRESPONDENT]

DEXTER, N. Y., December 26, 1939—At a meeting held last week Federal Judge Frank Cooper granted permission to the Dexter Sulphite Pulp and Paper Company to obtain a loan of $150,000 for necessary working capital. The loan is to be obtained on receivers' certificates which will be paid up out of mill earnings or from funds in the hands of the receivers. The order authorizing the loan was granted on application of A. Raymond Cornwall as attorney for the receivers, Brayton C. Foster and Winfield E. McIntyre. It was stated that the order will allow the receivers to borrow whenever they can but, however, it is not expected any move will be made to secure the loan before the first part of the year. The hearing before Judge Cooper was of short duration, no opposition having been interposed to his application. While the mills have been running practically full time and showing a profit for the past several weeks it is claimed that the receivers have been hampered by lack of working capital. In order to obtain the most economical and efficient operation at least $150,000 is required, according to the petition filed by the receivers. With the mills now doing a profitable business under present market conditions it was argued by Attorney Cornwall at the meeting that lack of sufficient capital was hampering the receivers in that they were unable to take advantage of discounts in buying. Because buyers of the products take from sixty to ninety days to pay the receivers have not been operating long enough to build up a working capital, it was pointed out. It is expected that the receivers will apply to the Reconstruction Finance Corporation for the loan which would be made on receivers' certificates and become a first lien against the assets of the company. Irving Lessen, of Syracuse, appeared as attorney for Mrs. Florence E. Campbell and Mrs. Alice M. Campbell, who owns a substantial amount of the company stock.

## Abitibi Earns $596,952

[FROM OUR REGULAR CORRESPONDENT]

TORONTO, Ont., December 26, 1939—Earnings of Abitibi Power and Paper Co., Limited, Toronto, for November, 1939, prior to audit and charges for depreciation and bond interest, amounted to $596,952 compared with $544,827 in October and $348,883 in November, 1938.

Included in November, 1939, earnings is $144,826 received as premium on United States exchange. Bond interest for the month is exclusive of premium which would have to be paid to permit payment of such interest to be made in the United States as can be required.

Shipments of newsprint in November according to G. T. Clarkson, receiver and manager, amounted to 38,668 tons compared with 37,246 tons in October and with 30,937 tons in November, 1938.

Shipments of sulphite pulp in November amounted to 5,185 tons against 5,193 tons in October, 1939, and 3,293 in November last year. Present indications are that shipments of sulphite pulp in December will amount to about 5,000 tons as compared with 2,807 tons in December 1938.

Present indications are that shipments of newsprint in December will be about 26,400 tons compared with 29,313 tons in December 1938.

## Marathon Earns $592,474

[FROM OUR REGULAR CORRESPONDENT]

ROTHSCHILD, Wis., December 26, 1939—Net profits of Marathon Paper Mills Company were almost doubled during the fiscal year ending October 31, according to the report of D. C. Everest, president and general manager, issued to stockholders at the annual meeting at the company's offices last week. They increased from $267,135 in 1938 to $592,474 in 1939.

Mr. Everest announced that $520,552 was available for holders of common stock after deduction of preferred dividends. Net profits amounted to $2.60 per share as compared with 99 cents in 1938.

The regular 1½ per cent dividend on preferred was voted, payable January 1 to stockholders of record December 21.

Sales volume was increased by approximately 20 per cent over the previous year. Current assets are $6,235,000 and current liabilities, $1,723,000, a ratio of 3.6 to 1. In the previous fiscal year the assets-liability ratio was 2.86 to 1, based on assets of $5,624,000 and liabilities of $1,965,000.

An outstanding development of the fiscal year was an increase in plant facilities costing approximately $700,000. Most of this was spent for enlargement of the Menasha Products (carton) division at Menasha, Wis.

All officers and directors were re-elected as follows: C. C. Yawkey, chairman of the board; Mr. Everest, president and general manager; Leo Croy, Menasha, Wis., and John Stevens, Jr., vice-presidents; P. M. Wilson, secretary-treasurer; C. J. Winton, Jr., Minneapolis; M. P. McCullough, Ben Alexander and Lester Armour, Chicago; L. F. V. Drake, New York, and C. S. Gilbert. The assistant secretary and treasurer is A. M. Van Douser.

## Bird & Son Vote Dividend

[FROM OUR REGULAR CORRESPONDENT]

EAST WALPOLE, Mass., December 25, 1939—Directors of Bird & Son, Inc., declared a common dividend of 25 cents a share, payable Dec. 28 to holders of record Dec. 20. In three previous quarters the company paid 10 cents.

Bird and Son, Inc., office force, who help Santa every year, sent in their contribution to Santa's fund December 19.

It was $41, and will go a long way to tying up many, many bundles for youngsters who otherwise might be forgotten on the Day of Days.

## Scott Paper To Call Bonds

The Scott Paper Company has elected to redeem the entire principal amount of its 3¼ per cent convertible debenture bonds at 105 on February 5, 1940. As of the close of business Dec. 16, the original issue of $4,000,000 has been reduced to $799,000 by the retirement of $58,000 and the conversion of $3,143,000 into 78,575 common shares.

## Scott Paper Co. Pays Bonus

A Christmas service award was paid to all employes of the Scott Paper Company, Chester, Pa., and to members of the company's sales organizations throughout the country. Those who joined the company before January 1, last, received $25 plus $1 for each additional year of continuous service. Others received smaller amounts.

## American Paper Goods Gives Bonus

The American Paper Goods Company, Kensington, Conn., distributed a Christmas bonus to 450 employees of its two plants at Kensington and Chicago. Workers on the pay roll before September 1 received a week's pay, others a half-week's pay.

## A. P. W. Paper Shares Listed

The New York Stock Exchange has authorized for listing 73,689 additional common shares of A. P. W. Paper Company, Inc., to be issued in conversion of twenty-five-year 6 per cent convertible notes, due 1955.

## Price Bros. Pay Regular Dividend

[FROM OUR REGULAR CORRESPONDENT]

MONTREAL, Que., December 26, 1939—The declaration by Price Brothers and Co., of a regular quarterly dividend of $1.37½ on the new preference stock, plus another $1.37½ dividend on account of arrears, has called attention to the recent sharp improvement in the earnings of Canadian newsprint companies. The last annual statement of Price Bros., for the fiscal year ending March, 1939, showed earnings of less than 6 per cent a share on the new preferred. During the 1939 calendar year the earnings of the company have improved steadily, and recently profits have been given an extra strong boost by the drop in the Canadian dollar to 10 per cent discount in terms of the U. S. dollar. Owing to changed dates in the company's fiscal year, the next earnings statement will be for the nine months ending December 31, 1939. This is expected to show profits of more than $3.50 a share on the preferred.

The two dividends of $1.37½ each are payable December 31 to stock of record December 19. With continuance of present rate of earnings, it can be assumed that company will pay regular dividends on the preferred from now on and clear up dividend accumulations, which amount to only $2.50 a share—after current payment. Company has outstanding 62,843 shares $100 par 5½ per cent preferred stock, cumulative as to dividends from January 1, 1939, and 547,857 shares of common, exclusive of 131,227 reserved for conversion of its 4 per cent debentures. Working capital on March 31, 1939, was reported at $7,259,357, although current liabilities included $3,675,000 secured bank loans, which, however, have been steadily whittled down with reduction of pulpwood inventories.

## A Short Course in Paper Making

The P. H. Glatfelter Company, Spring Grove, Pa., has produced a moving picture film entitled "A Short Course in Paper Making." As the title indicates, this film depicts the fascinating story of how paper is made today. Its continuity is complete from wood cutting operations to shipping the finished product, and as such is of great educational value.

This film is available to all business and fraternal organizations, social clubs, schools, and individual business firms. A print will be mailed without charge and may be secured by writing to the P. H. Glatfelter Company, Spring Grove, Pa.

A sound film completely narrated is now available. After February 1, 1940, a silent film well titled will also be available.

The talkie is in 16 mm. size only, is 1200 feet long, requiring approximately 32 minutes for showing, and must be used on a sound projector for the sound track is on the film.

The silent film will be three reels of 400 feet each, requiring the same length of time for showing, and will be available also in 16 mm. size only.

The P. H. Glatfelter Company is well qualified to present a complete story of papermaking, being fully equipped with machinery of the most recent design, and operating a pulp mill as well as a paper mill.

This concern, now completing its seventy-fifth year under the ownership and operation of the Glatfelter family, are prominent manufacturers of book, bond, offset, mimeograph, and converter papers.

# To Take Censuses of Business and Manufactures

[FROM OUR REGULAR CORRESPONDENT]

WASHINGTON, D. C., December 27, 1939—The paper industry is an important one among the four hundred American industries, concerning whose operations in 1939 the U. S. Bureau of the Census is gathering vital facts and figures to be tabulated in 1940 as results of the Sixteenth Decennial Census are compiled and published. This inventory, so far as industries are concerned, will cover activities during the calendar year of 1939 except in those instances where paper firms operate on a fiscal year basis.

### Under Way in January

Under way in January were the Censuses of Business and Manufactures, the opening phase of the vast enumeration scheduled for 1940. Twelve thousand enumerators for these economic censuses are in the field delivering questionnaires to more than 3,000,000 retail and wholesale distributors and about 200,000 manufacturers in the 400 industries involved. The Census of Manufactures is a comprehensive nationwide enumeration of every production activity, while the Census of Business covers the distribution of products.

Although some changes appear in the revised schedules of questions being used by the U. S. Bureau of the Census in enumerating the paper, pulp, and allied industries under the 1940 Census of Manufactures, these changes are mainly for administrative purposes and will not affect the work of Census enumerators in the field. Alterations by the bureau in its classifications of paper activities, however, will assure easier interpretation of final reports on certain phases of the industry.

### Coated and Glazed Paper

One classification followed in the 1937 Census of Manufactures has been revised to separate "Coated and Glazed Paper" figures from "Converted Paper Products not elsewhere classified."

A second classification which was used in 1937, was "Boxes, paper, not elsewhere classified," and included boxes or containers, of paper, newsboard, or cardboard, plain or metal-edged, to hold confectionery, millinery, cigarettes, druggists' preparations, etc. This has been adjusted for the new census, and separate figures will now be available to cover "Fiber cans and tubes, and similar products." The remaining items will be classed as "Paperboard containers and boxes not elsewhere classified."

The question concerning "Pulp goods, pressed and molded," is an addition to the 1940 paper group. Formerly it was presented under the Forest Products' grouping of "Synthetic resin, cellulose-plastic, vulcanized fiber, and molded and pressed pulp fabricated articles."

### Paper and Allied Classification

Those to be included in the enumeration under the paper and allied classifications for the 1940 Census include:

Pulp mills; paper and paperboard mills; coated and glazed paper; envelopes; paper bag mills not operating paper machines; fiber cans, tubes, and similar products; paperboard containers and boxes not elsewhere classified; die-cut paper and paperboard (cards, boards, milk-bottle caps, etc.); wallpaper; pulp goods, pressed and molded; converted paper products not elsewhere classified.

The "die-cut" item for the 1940 schedule covers the 1937 listings of "Card-board not made in paper mills" and "Card Cutting and Designing."

For paper manufacturers, the questions asked will result in a complete and up-to-date picture of the American paper industry for the calendar year of 1939 (fiscal year reports will be accepted from firms operating on that basis).

### What the Schedule for Paper Includes

The Manufacturers Census schedule for the paper industry includes queries on description of plant and legal form of organization; location; number of employees and officers classified according to type of work performed; wage earners employed "by months," salaries and wages paid; cost of materials, supplies, containers for products, fuel, purchased electric energy, contract and commission work actually used or performed during 1939; type and horsepower rating, etc., of power equipment in plant (prime movers, generators, electric motors); fuel and electric energy used; expenditures for plant, equipment, and real estate during the year; inventory at beginning and end of year.

### Specific Information

Specific information also is asked concerning type of products made and total work done during the year, with specific breakdowns under newsprint, groundwood printing and specialty papers, book paper, writing, wrapping paper, tissue, absorbent, building and other papers; boards, container boards, binder's board, Bristol board, building boards, etc.

### Wrapping Paper

Under "wrapping paper," for instance, the schedule calls for figures on quantities and values of stock produced (1) for use in owner's plant, (2) produced and transferred to other plants of same company, (3) and produced for sale, on such wrapping paper items as butchers' and grocers' paper, bag paper, machine-glazed and other wrapping grades, under the separate headings of (1) unbleached sulphite and semi-bleached sulphate stock and (2) bleached sulphite and bleached sulphate stock; wrapping and envelope manila, greaseproof, glassine, vegetable and other imitation parchment, Kraft, etc.

Manufacturers also are asked to enumerate converted products made in the same plant, chemicals produced, quantity and cost of chief materials used, man-hours expended, etc. Facts as to paper-making equipment in use or available for use on the last day covered by the report will also be required. In addition, each manufacturer's schedule includes a sheet

covering distribution of sales and interplant transfers of products.

### Special Schedule for Pulp

In the special schedule of questions for pulp manufacturers or makers of converted paper products are generally similar to those for paper producers. Appropriate changes are made in the detailed queries concerning specific products. For the converter, for instance, space is given to allow inclusion of details on 40 different basic paper products, with separate breakdowns under some of these items and room for addition of "other products."

America's pulp mills are being asked for figures on cordage and costs of pulpwood consumed, by kinds of wood and process of manufacture.

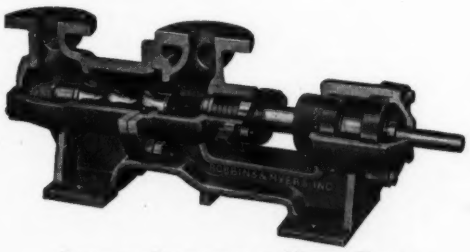
### Distributors of Paper

Distributors of paper and paper products, of course, are being canvassed under the Census of Business, taken concurrently with the Manufacturers enumeration. These 1940 Censuses are part of the tremendous Sixteenth Decennial Census, which besides business, manufactures, and mines and quarries, includes complete national "nose-countings" of population, housing, occupations, employment, agriculture, and drainage and irrigation. These "domestic" censuses are slated to start in April.

At least the basic facts will be published by the Census Bureau by late summer or early fall. These will be followed as rapidly as possible by more detailed reports. It is expected that the field work will be completed within about five months.

## Moyno Pumps In Paper Field

The Moyno Pump, manufactured by Robbins & Myers, Inc., Pump Division, Springfield, Ohio, is entirely new in principle. It has been, however, thoroughly proven in service. It is not a screw pump, it is not a centrifugal pump, it is not a reciprocating pump, . . . yet it combines many of the desirable principles of all these. It is self-priming, it is valveless, it is positive in displacement and it will handle solids in suspension. It delivers a uniform flow with minimum agitation.



SHOWING SIMPLICITY OF MOYNO PUMP.

The Moyno pump has proven very well suited to the handling of paper coating solutions (clay slip) and pulps of certain types and within certain limited volumes and temperatures. In general a 47 to 70 Durometer rubber is used in the stator, dependent on the pressure and abrasive qualities involved. The limiting volume is 125 gpm. represented by operation of the No. 10 pump at 860 rpm. maximum. An interesting circular fully describing the Moyno pump may be had for the asking.

# Obituary

### Hugh K. Moore

DUNEDIN, Fla., Dec. 19—Dr. Hugh Kelsea Moore, 67, chemical engineer, who held 50 patents for processes relating to paper and pulp manufacture and electro-chemistry, died at Dunedin, Fla., on December 18, of a heart ailment.

Mr. Moore was chief chemical engineer of the Brown Company of Berlin, N. H., from 1904 until he retired in 1934. He was president of the American Institute of Chemical Engineers in 1925-26 and received the institute's gold medal in 1920 for the best contribution to applied science since 1913.

Among Mr. Moore's notable achievements were the development of an explosion process for recovering soda salts from a by-product of pulp, the construction of a multiple effect evaporator to recover soda from waste pulp liquor, and a new alkali process for producing caustic soda.

During the World War he was a member of the chemical engineers' committee of the Council of National Defense, and was treasurer of the New Hampshire branch of the Naval Consulting Board.

In 1925 he received the Perkin Medal for outstanding contributions in applied chemistry, and was the author of many books on chemical and sociological subjects.

### F. A. Silcox

Ferdinand A. Silcox, chief of the Forest Service of the Department of Agriculture, died December 20, of a heart attack. He had been ill at his home in near-by Alexandria, Va., since last Wednesday. He would have been 57 years old on Christmas Day.

Mr. Silcox became chief of the Forest Service on Nov. 15, 1933, after the death of Robert Y. Stuart. He entered the service in 1905 as a forest assistant and rose through the ranks until he became regional forester in 1910 of the Northern Rocky Mountains, in charge of all activities on 26,000,000 acres of national forest lands in three Northwestern States.

In the World War he was a major of the Twentieth Engineers and was in the service from August, 1917, to April, 1918.

In April, 1918, he came East to coordinate Federal employment offices with the States, reorganized the New York office and State and Federal cooperation offices throughout Massachusetts. A year later he became director of industrial relations of the commercial branch of the printing industry of the United States and Canada.

In 1922 he went from this position to become director of industrial relations for the New York Employing Printers Association in New York, holding that post for eleven years.

In 1936 Mr. Silcox served as arbitrator in the famous New York elevator strike.

### Samuel D. Darby

Samuel D. Darby, retired paper manufacturer, of York, Pa., died at Pelham Manor, N. Y., on December 21 at the home of his daughter, Mrs. John H. Noble, at 12 Sherwood Avenue, after a long illness. A son, Myron G. Darby, of Bronxville, N. Y., and four grandchildren, also survive.

# Michigan Superintendents Have Duck Dinner at Kalamazoo

KALAMAZOO, Mich., December 22, 1939—C. "Baldy" Smith and Roy W. Holden were hosts to the Michigan Division of the superintendent's association at their December meeting, when these two gentlemen put on their yearly duck dinner to which the association members were invited guests. The dinner has long since assumed the nature of a classic and is eagerly looked forward to by those fortunate enough to be included. A floor show and orchestra furnished entertainment during the dinner, and the regular meeting followed. Messrs. Root, Vokes, and Colitre of the Dilts Machine Works, Fulton, N. Y., furnished the serious part of the program. Mr. Root gave a talk on one of the company's newly developed machines, the Dilts-Cowles Hydro-pulper, the address being augmented by two roles of film showing the Pulper in actual operation. The address was highly interesting and at its close an instruction followed. Due to the presence of three company representatives, they were well fortified to answer in detail all questions put to them, and in a highly satisfactory manner.

Those attending the meeting were Harvey Hartman, American Box Board Company; A. E. Hays, Michigan Paper Company; Fred Hodgmier, Hawthorne Paper Company; R. W. Holden, Stowe Woodward Company; E. A. Honey Jr., John Hartman, Kalamazoo Vegetable Parchment Company; H. B. Johnston, Allied Paper Company; L. H. La Laberten and Frank Libby, Kalamazoo Vegetable Parchment Company; Lloyd J. Lynd, Adam Kuchta and W. A. Kirkpatrick, Allied Paper Company; R. R. Milroy, Paper Mill Supplies; L. M. Monrieg, U. S. Rubber Company; H. C. Pearson, Pioneer Paper Stock Company; A. N. Petersen, Kalamazoo Vegetable Parchment Company; John L. Russel, Bryant Paper Company, E. C. Rutz, Bryant Paper Company; George H. Rice, Kalamazoo Vegetable Parchment Company; A. M. Riedel, Riedel Brush Works; Edwin M. Root, Dilts Machine Works; Irving Sisson, Watervliet Paper Company; Art Stolle and L. J. Scheid, Watervliet Paper Company; H. E. Stratton, PAPER TRADE JOURNAL; Clem Sisson, Mac Sim Bar Paper Company; Rolland D. Smith, Stein Hall Manufacturing Company; C. "Baldy" Smith, Huron Milling Company; T. Arcronin, Shartle Brothers Machine Company; W. Hastle, Michigan Paper Company; Willard Barnhart, American Box Board Company; Jake Boodt, Kalamazoo Paper Company; Barney Benson, Williams-Gray Company; Harry C. Bradford, Rex Paper Company; E. H. Barnes, Michigan Carton Company; Frank L. Brown, Michigan Paper Company; Gray Blockman, Ray L. Barton, Michigan Paper Company; W. B. Colitre, Dilts Machine Company; Wayne E. Crotty, Bryant Paper Company; A. W. Cole, Rex Paper Company; E. M. Cowling, Hawthorne Paper Company; Kenneth Conrad and Norman J. Cowie, American Box Board Company; O. W. Callighan, Edgar Brothers Company; W. M. Carrol and W. M. Carrol Jr., Allied Paper Company; P. F. Denner, Kalamazoo Paper Company; Paul de Guehery, Michigan Paper Company; Paul Dumas, Chromium Corporation; F. B. Eilers, Orr Felt and Blanket Company; H. S. Faram, Watervliet Paper Company; O. F. Fischer, Bryant Paper Company; M. S. Fogerty, Michigan Paper Company; Tom Falknor, Edgar Brothers Company; Arthur Fitzgerald, Herman Frank, Buster Griffiths, Williams-Gray Company; Carl Swanson, Allied Paper Company; William Shaw, Michigan Carton Company; Homer Stafford and Robert B. Stewart, Kalamazoo Vegetable Parchment Company; Glen Sutton, Sutherland Paper Co.; Jacob Parent, Noble Wood Company; Al Perlick, Kalamazoo Vegetable Parchment Company; Leon H. Mimms, Kalamazoo Paper Company; Henie Nendorf, Rex Paper Company; James R. Verdon, American Cyanamid Corporation; Robert F. Vokes, Dilts Machine Works; A. E. Woollam, Woollam Company; James A. Wise, Kalamazoo Paper Company; Arnold Weller, Sutherland Paper Company; William Wessel, American Box Board Company; F. O. Ware, Watervliet Paper Company; F. B. Wells, Walter F. Wolfe, Mac Sim Bar Paper Company; C. A. Yonker, Allied Paper Company; F. L. Zellers, French Paper Company.

## Trade Association Gives Party

[FROM OUR REGULAR CORRESPONDENT]

PHILADELPHIA, Pa., December 26, 1939—Above the clatter of the city sixty boys and girls recruited from the ranks of the Salvation Army's Settlement House, sang the traditional carols of Christmas last Tuesday in the Arcadia Restaurant, where they were the guests of the Philadelphia Paper and Cordage Association, Inc., at their annual Christmas party.

E. K. Lay, a past president of the Association, was chairman of the Entertainment Committee that made possible the elaborate program that was presented. The party began with a ride in autos furnished by Frank W. Winnie & Son, Inc., and J. E. Fricke Company, who brought the children from the Settlement House to the Arcadia, and at the close of the festivities each child was transported to his or her home through the generosity of these firms.

Notably present were Lee Johnson, Gummed Products Company, Frederick I. Brower, Atlantic Gummed Paper Company, Ormond Freile, vice president, Paper Merchants, Inc., Joseph H. Miller, vice president, Garrett-Buchanan Company, Simon Walter of S. Walter, Inc., and Vincent Dirvin, Paper Manufacturers, Inc. Notably absent was Sam Shyrock of Shryock Brothers, who has always taken an active part in the Association's activities, but who, on this occasion, sent a telegram of greetings to all and expressing his regret at not being able to attend because of a recent indisposition.

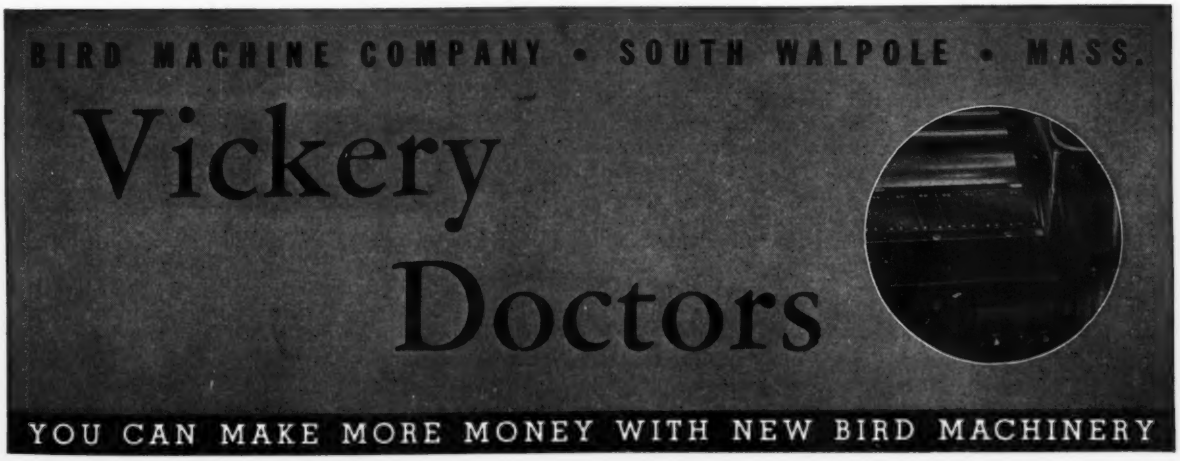
The newly elected officers for 1940 are George K. Hooper, president; Joseph H. Miller, vice president; Everett Hoffman, treasurer; F. M. Kurz, secretary. The directors for 1940 are Arthur Sherrill, E. K. Lay, E. L. Richards, Harry S. Platt, J. R. Howarth, and John J. Shinners. This, by the way, is the sixth time that Mr. Hooper has been elected to the presidency of this Association.

# 160

# VICKERY CALENDER DOCTORS

## FOR ONE MILL

If there's a single calender roll in your mill that's allowed to go dirty or that's doctored only when threading the rolls or clearing up after breaks, here's a fact that will interest you. One papermaker is so sold on the value of *continuous* Vickery Doctoring that he's now equipping every roll on 18 big stacks. He figures the savings in paper from eliminating calender marks will quickly pay for the Vickery Doctors, let alone the savings in roll maintenance . . . Why not get the whole story including layouts and estimates?



# Government Paper Bids and Awards

[FROM OUR REGULAR CORRESPONDENT]

WASHINGTON, D. C., Dec. 27, 1939—The Government Printing Office has received the following bids for 17,250 pounds (150,000 sheets) of 50% rag, 21" x 32" white ledger paper; Mudge Paper Company, 9.58 cents; Baxter Paper Company, 10.5 cents; Butler Company, 10.48 cents; Stanford Paper Company, 10.25 cents; Barton, Duer & Koch Paper Company, 10.25 cents; R. P. Andrews Paper Company, 11.33 cents; Paper Corporation of United States, 10.03 cents; Aetna Paper Company, 9.23 cents; and Old Dominion Paper Company, 10.248 cents.

For 41,900 pounds (299,000 sheets) of various sizes white sulphite ledger paper; Barton, Duer & Koch Paper Company, 6.07 cents; Stanford Paper Company, 7.5 cents; R. P. Andrews Paper Company, 5.97 cents; Marquette Paper Company, 5.7 cents (bid based on award all sizes); Mudge Paper Company, 6.11 cents; Cauthorne Paper Company, Inc., 6.18 cents; Walker, Goulard Plehn Company, Inc., 5.98 cents less 2%; and Old Dominion Paper Company, 7.07 cents.

For 1440 pounds 21" x 32" white tissue paper; Mathers-Lamm Paper Company, 11.55 cents; R. P. Andrews Paper Company, 13.13 cents; Mudge Paper Company, 12.61 cents; and Old Dominion Paper Company, 12.99 cents.

For 10,000 pounds (50,000 sheets) of 22½" x 28½" jute tag board; Mudge Paper Company, 8.05 cents; and Whitaker Paper Company, 8.139 cents.

For 1,000 sheets of 18" x 23" overlay board; Martine Cantine Company, 38.5 cents; and R. P. Andrews Paper Company, 34.8 cents.

For 42,250 pounds (250,000 sheets) of 28" x 41" dull coated book paper; Stanford Paper Company, 7.17 cents; Whitaker Paper Company, 7.03 cents; Barton, Duer & Koch Paper Company, 7.06 cents; R. P. Andrews Paper Company, 8 cents; Mudge Paper Company, 7.1 cents; Virginia Paper Company, 7.15 cents; and Enterprise Paper Company, 7.373 cents less 1%.

For 17,500 pounds (100,000 sheets) of 29" x 41" coated book paper; Whitaker Paper Company, 6.84 cents; Stanford Paper Company, 6.99 cents; Virginia Paper Company, 7.35 cents; Barton, Duer & Koch Paper Company, 7.27 cents less 1%; and Enterprise Paper Company, 7.575 cents.

For 15,000 pounds (21,000 sheets) of 22" x 32" marble grained lined board; Mathers-Lamm Paper Company, 6.3 cents.

For 5,100 pounds (50,000 sheets) of 50% rag, 28" x 34" green bond paper; Aetna Paper Company, 11.43 cents; Barton, Duer & Koch Paper Company, 11.25 cents; R. P. Andrews Paper Company, 11.24 cents; Stanford Paper Company, 8.88 cents; Perkins-Goodwin Company, 14.75 cents; Old Dominion Paper Company, 13.98 cents.

For 45,600 pounds (600,000 sheets) of M. F. book paper; Perkins-Goodwin Paper Company, 5.52 cents; R. P. Andrews Paper Company, 4.73 cents; Stanford Paper Company, 4.73 cents; Whitaker Paper Company, 4.71 cents; Barton, Duer & Koch Paper Company, 5.52 cents; Marquette Paper Company, 5.38 cents; Mudge Paper Company, 5.53 cents; Paper Corporation of United States, 5.49 cents; Mathers-Lamm Paper Company, 4.89 cents; Enterprise Paper Company, 4.94 cents.

For 61,904 pounds (292,000 sheets) of 50% rag, 22" x 34" white index paper; Walker, Goulard Plehn Company, 12 cents less 2%; Aetna Paper Company, 8.13 cents; Barton, Duer & Koch Paper Company, 8.04 cents; Old Dominion Paper Company, 8.998 cents; Marquette Paper Company, 7.96 cents; R. P. Andrews Paper Company, 10.13 cents; Mudge Paper Company, 8.08 cents; Mathers-Lamm Paper Company, 8.43 cents; and Perkins-Goodwin Company, 12.25 cents.

For 1,000 pounds of 19" x 24" white stereotype molding paper; Cauthorne Paper Company, Inc., 8.9 cents; and Russell Products Company, 11.5 cents.

## Flexible Woven Wire Conveyor

A new 44 page Catalog No. 50-83 entitled "Audubon Metalwove Belts" shows numerous types of conveyor and processing belts which can be obtained in any ductile metal most resistant to various operating conditions, i. e., flame, high temperatures up to 2100 deg. F., sub-zero temperatures, corrosion, contamination, abrasion, impact, etc. These belts have the longitudinal flexibility of leather, canvas or rubber. Thus they can successfully run over small diameter pulleys and take acute reverse bends.

Various weaves, meshes and wire diameters are pictured which give numerous percentages of open area for the drainage of liquids or the circulation of air, gas or steam through these belts. Likewise, various types are shown which provide means for the safe handling of fine, coarse, heavy, granular, soft, fibrous, plastic, fragile or readily marked materials and for sorting, grading, sieving, classifying, etc.

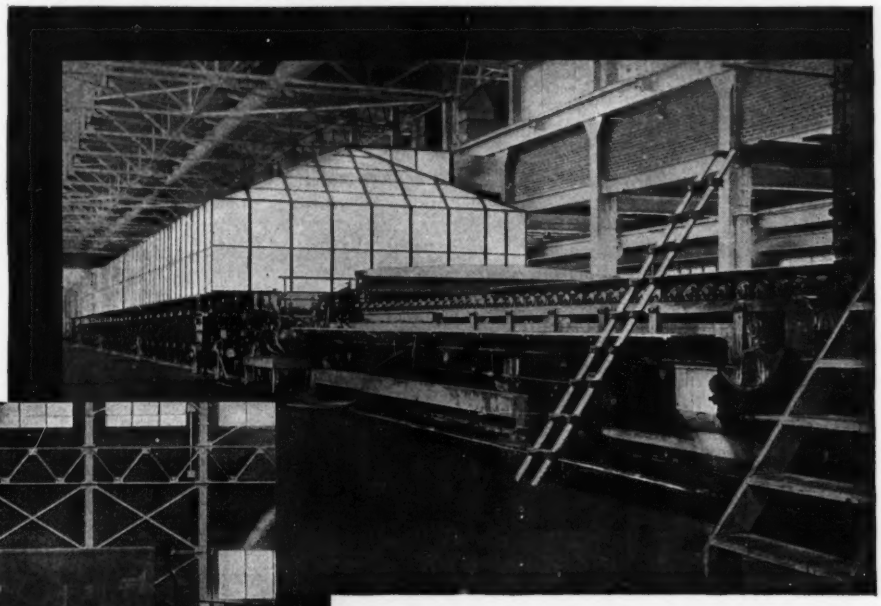
The catalog contains 120 photographic illustrations of various belts, four engineering diagrams showing how to design and construct these conveyors for these belts, engineering and operating hints, specifications for belts and a questionnaire form listing the information desired by the manufacturer for making recommendations of the correct belt to solve individual problems. Address the Audubon Wire Cloth Corporation, Richmond street and Castor avenue, Philadelphia, for a copy of this catalog.

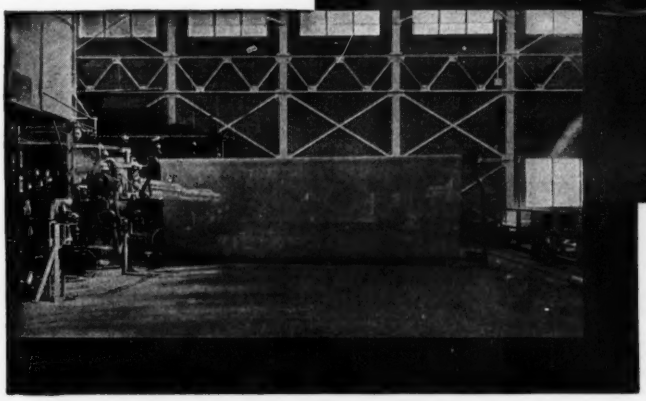
## Four New Pulp Mills for Italy

Four new plants for the production of chemical pulp are being constructed, with Government assistance, at Cueno, Chieti, Capua, and Final de Reno (province of Ferrara), Italy. These plants are to have a production of around 20,000 metric tons each, per annum, and will use domestic raw materials exclusively. The plant in Cueno is scheduled to begin operation in January and will use pine and chestnut wood.

A further addition to the Italian production of chemical pulp is to be made by a large Italian paper mill which will produce cellulose from wood shavings by the soda process.

# THE BELOIT *Removable Fourdrinier*





● Wire is strung in aisle while machine is in operation, if desired.

● Fourdrinier pit can be washed out while wire is being installed.

● Wire bundle is taken from shipping box and mounted directly in carriage—no chucks to apply—no further handling as bundle is unreeled as carriage moves along to form wire loop.

● All wire poles are mounted in carriage before loop is formed. Inside poles are inserted inside the wire.

● Safest — most convenient — quickest method of installing Fourdrinier wire.

THE BELOIT WAY BELOIT IRON WORKS PAPER MACH'Y BELOIT, WIS. U.S.A. IS THE MODERN WAY

# Pine Pulpwood From Logging Tops

## Foresters and Pulpmills Find a New Use for a Waste Product

By Texas Forest Service, A. and M. College, E. O. Siecke, Director

The saying, "Woodman spare that tree," is changing in East Texas these days to "Woodman use that tree!" And using it, he is. The timber operator is not only harvesting the lower trunk of the tree but is even going after the wood in the tops. On the use of the topwood hinges one of the most interesting stories and most far reaching conservation developments originating in East Texas forests in recent years. Perhaps it is strange that use of topwood spells conservation. But it does, because complete utilization is the first step in conservation. It means elimination of waste!

### Topwood Had Little Use

In all fairness, though, topwood has not in the true sense been a waste product. Topwood, or logging tops, is the tops of the trees left after sawlog cutting operations have taken the lower trunk. Outside of a small amount utilized as fuelwood, these logging tops, with no available market, have for the most part laid in the woods unused, creating a high fire hazard, and have caused much unfair criticism to be cast on the lumberman's head because of the slashed-over appearance they give the forest. This has been a very unfortunate situation because the lumberman has not been to blame. His job has been to cut sawlogs that would produce lumber which must conform to a rigid set of specifications. Lumber cut from top logs, being of low grade and value, would not pay its way. As a result the tops have had to be left in the woods.

Thus the problem existed in 1936. In that year, however, the Champion Paper and Fibre Company erected a sulphate mill at Pasadena, Texas, which was to manufacture pulp from Texas timber. With the building of that mill a ray of hope appeared for finding a use for the sawlog tops—making them into pulpwood.

Accordingly, a three-way project was initiated in 1937 by the Texas Forest Service of A. and M. College, in cooperation with the Champion Company and the Texas Long Leaf Lumber Company of New Willard. The lumber company produced the pulpwood from logging tops on one of its cutting operations, the Texas Forest Service furnished the technical assistance and kept the records, and Champion bought the pulpwood and processed it at its mill near Houston. The report came back from Champion—"Topwood suitable for sulphate pulping when cut immediately behind logging, properly knotted and care exercised in selecting tops to be worked."

Today, two years from the time the project was initiated, several of the Champion Paper and Fibre Company's wood contractors are cutting pulpwood on a number of operations from logging tops and tie tops. That means a lot, namely, that the project has developed into one of commercial importance, which definitely proves its value.

### Timberland Owner Benefits

How does the timberland owner benefit? First, he gains an additional profit from his forest holdings by utilizing a former unmerchantable product. It has been shown that on an average about one-half cord of pulpwood can be made from the tops of every 1,000 board feet of sawlog trees. There are examples of some owners getting as many as six or seven 5-foot cuts of pulpwood from the top of one tree. Think of it, 30 to 35 feet additional tree length used that formerly had no market. The amount of pulpwood obtained from the tops varies of course, depending mostly on the type of timber. The average is probably nearer four to five sticks of pulpwood per tree top.

Then, the timberland owner benefits from the reduced fire hazard resulting from the salvage operations. Where before tops lay in a jungled mass, often high off the ground, a dreadful fire trap, the

FIG. 1.

Notice the amount of wood left in these pine tops. Unutilized, they formerly represented a loss of an enormous volume of wood fiber each year and created a serious fire hazard. Now valuable as pulpwood such tops can be used in many sections of East Texas.

FIG. 2.

This timber stand on Texas State Forest No. 3, located in Cherokee County, has just been cut selectively and now foresters are making pulpwood out of the logging tops left behind the cutters. The top shown in the foreground yielded seven sticks of pulpwood.

FIG. 3.

Reagan Smith, pulpwood contractor at Conroe, Texas, stands beside a pine top that his crews have just cut into pulpwood. This top made six 5-foot sticks of wood. Notice how little of the tree is wasted under this new forest conservation practice.

FIG. 4.

This pile of pulpwood represents the wood obtained from the tops of two trees previously cut for sawlogs. Because in the stick on the left the limbs were not cut off flush, it will be rejected. The stick on the right, although as knotty, is acceptable as pulpwood.

tops remaining after pulpwood has been cut are low to the ground and rot away in a short time. Should a forest fire start, the chances against its flaring up into the crowns of the standing timber are much less.

It should be pointed out here that these benefits are possible for the farmer as well as the owners of larger tracts of timberland. East Texas farmers own about sixty per cent of the forest land in the piny wood section. They are important producers of forest products. Producing pulpwood from logging tops in their timber cuttings would afford them an added income from their farm woodlands and the other advantages possible under this practice.

The beneficial effects of salvaging pulpwood from logging tops also mean a lot to forestry in Texas. For example, it not only creates an additional value for the timber but also offers opportunities for additional employment of woods labor. Then, probably greatest benefit of all, it lessens proportionally the annual requirements on standing timber necessary to otherwise meet the pulpwood market demand.

### Mills Can't Run Entirely On Tops

In this respect, the pulpmills cannot be expected to run on wood produced from the central stems of logging tops entirely. Pulpwood from tops of course contains more knots than wood cut from the body of the tree and cutters must exercise care in selecting tops and then make sure that knots are trimmed flush to the body of the stick. This is necessary in order that the bark can be removed in the big barking drums at the plant. The yield of pulp from logging topwood is lower than from clear wood because the knots do not digest properly in the chemical cooking process and are lost on the screens.

There is a great potential supply of topwood available in standing timber in East Texas today. The recent forest survey conducted by the U. S. Forest Service has estimated the wood volume in pine timber of sawlog size to amount to over 41 million cords. Approximately seven and a half million cords of this total volume are in the tops. Foresters estimate there were over 300,000 cords of stemwood left in the unmerchantable tops of pine sawlog trees in 1938.

### Future Prospects Bright

It is true that the possibilities of producing pulpwood from logging slash are limited to areas from which pulpmills manufacturing pulp by chemical processes are drawing their wood supplies. With the expansion of the industry it may be assumed that new mills can also look to logging tops partially to supply their yards. Within the present pulpmill areas, however, the production of pulpwood from topwood is a forward step. It means more complete utilization of many trees, increased opportunities for woods labor, reduced forest fire hazards, a better balance on our annual wood requirements. Complete utilization is the first step to wise conservation!

## Canada Can Supply British Needs

[FROM OUR REGULAR CORRESPONDENT]

MONTREAL, Que., December 26, 1939—According to a report received from G. R. Heasman, Canadian Trade Commissioner at London, the reduction which has taken place in the size of British newspapers will enable the United Kingdom to produce sufficient newsprint, roughly speaking, for that country's requirements. On the other hand, the demand for wrapping papers and board, especially of the better quality, may increase due to the war, notwithstanding any economies among the civilian population. Imports of bonds, writing papers and specialty papers may be drastically curtailed.

The Ministry of Supply has taken over all stocks of wood-pulp at the actual cost of importation, and an average price for each class has been calculated. The efforts of the Control Board have been largely directed so far to keeping down prices of paper, and paper-making materials already in the United Kingdom, the latter being recently placed on the list of goods the importation of which is prohibited except under license.

## Roger D. Smith Gets Loving Cups

[FROM OUR REGULAR CORRESPONDENT]

BOSTON, Mass., December 26, 1939—President Roger D. Smith, who will have been fifty years with the S. D. Warren Company January 1, 1940, was presented with two loving cups of gold, made from the melting of old jewelry contributed by the office staff at a Christmas Party in his honor Thursday evening, December 21. A Christmas tree, office decorations of gold, and a dinner were among the features of the occasion.

## New Literature

Close-coupled centrifugal pumps are described in Bulletin, B-6018, issued by the Centrifugal Pump Division of Allis-Chalmers Manufacturing Company, Milwaukee, Wis., under the title, "How to get more gallons at less cost." It gives a description of these small size pumps which have many varied applications, with construction details, capacity tables and other useful data.

Folding cartons, is the title of a booklet issued by the Container Corporation of America, 111 West Washington street, Chicago, Ill. It concisely describes the construction, design, production and service rendered by the folding carton.

Automatic lubrication, is described in Bulletin J, issued by the Bijur Lubricating Corporation, Long Island City, N. Y. It describes the advantages of maintaining machine efficiency by means of automatic centralized pressure lubrication systems.

Oil circuit breakers, Types D.20, and K.D.20, are described in Leaflet B-6023, issued by the Allis-Chalmers Manufacturing Company, Milwaukee, Wis. It covers oil circuit breakers of moderate capacity, with three poles in one tank, capable of wide application to central station and industrial service, where economy and space are important factors.

Hewitt Magazine, published quarterly by the Hewitt Rubber Corporation, Buffalo, N. Y., contains information on the use of rubber in industry.

The new "Oil-ir," air-line lubricator is described in Folder 2600, issued by the Ingersoll-Rand Company, Phillipsburg, N. J. It is stated that this lubricator will not "siphon back" and can be used on many kinds of air operated tools.

Turbine well pumps are described in Bulletins H-450-B29 and H-450-B30, issued by the Worthington Pump and Machinery Corporation, Harrison, N. J. This is a new line of turbine well pumps and features vacuum molded impellers.

Pressure vessels and heat exchangers are described in Bulletin 1020 issued by the Alco Products Division, American Locomotive Company, 30 Church street, New York. The Alco pressure vessels can be built to meet specified performance and to the users design and of carbon and alloy steels. The Alco heat exchangers for general industrial use are rated and designed for the specific duty to be performed.

Water problems are discussed in the booklet, "H-O-H Lighthouse Reprints," issued by D. W. Haering & Company, 2308 South Winchester avenue, Chicago, Ill. This is a reprint of the booklet covering hot water conditioning, cooling systems, heating systems, internal combustion engines, and chain systems.

Barometer condensers are described in Bulletin 9424, issued by the Ingersoll-Rand Company, Phillipsburg, N. J. The merits of the company's Disc-Flow, counter-current type are described, with specifications and diagrams of operation.

Rotary positive gas exhausters and boosters, are described in Bulletin No. 32-33-B-11, issued by Roots-Connersville Blower Corporation, Connersville, Ind. This equipment is used in chemical processes and in sulphuric acid plants and wherever gases have to be moved under moderate pressures.

Corrosion and heat resistant cast iron pipe, is the subject of a bulletin issued by the Walworth Company, 60 East 42nd street, New York. It describes the company's "Ni-Resist" pipe recommended for such services as caustic lines, and sulphite pulp mill blow pit waste lines. Chemical properties of the product are given and valves and fittings in "Ni-Resist" are described.

Gas engines and gas engine compressors are described in two bulletins issued by the Worthington Pump and Machinery Corporation, Harrison, N. J. Bulletin S-550-B 15, gives particulars of the company's vertical fourcycle engine, which is entirely enclosed. The "Unibloc" gas engine compressors are described in Bulletin S-550-B 17. This equipment consists of a vertical four-cycle gas engine with a vertical cross-head type compressor an integral part.

Ideal products, including a varied line of small tools, etc., are described in a catalogue issued by the Ideal Commutator Dresser Company, 1250 Park avenue, Sycamore, Ill. This booklet is of particular interest to electricians, engineers, mechanics, superintendents and production managers.

Balanced "Monobloc" centrifugal pumps are described in Bulletin W-322-BID, issued by the Worthington Pump and Machinery Corporation, Harrison, N. J. The advantages of the balanced "monobloc" are also described, with ratings and dimensions, in Bulletin W-321-B 14. Some of the features are compactness, elimination of base plates, extra large shafts, and a streamlined, balanced design.

## Commemorate 50th Year in Business

The first paper mill of the J. P. Lewis Company was put into operation in 1889, although eight years before that, 1881, the first pulp mill was started and marked the beginning of the paper industry in that section. The company was founded by James P. Lewis and is now headed by his son Harry S. Lewis. The paper mill was the first to be built on the Beaver River, and the pulp mill was the second in the country to use hydraulic grinding, wood being ground previous to this date by the Voelter Method. Later another pulp mill was started. The original one machine paper mill, housed in a frame structure, was destroyed by fire in 1898. It was rebuilt and the company operated one machine until 1907, and in that year installed a second machine, and in 1917 No. 2 Mill, containing the third machine, was added. Today the company operates four cylinder machines in up-to-date, well lighted, modern buildings.

An interesting bit of history regarding the J. P. Lewis Company is the fact that Beaver Board, which became nationally known, had its origin at this mill, although no wall boards are now manufactured there. The company now manufactures fourteen stock lines of folding, index, printing and bogus bristols, post card, tags, blanks, railroad board, poster board and cover paper, and a variety of specialty boards and cardboards, including can stock, bottle cap board, wet machine boards and embossed and wood grained specialties. Their stock lines are carried by principal paper merchants in more than 100 cities in the United States.

In commemorating its 50th Anniversary, the J. P. Lewis Company is distributing the cardboard cupboard—a sample cabinet with 18 compartments containing swatches of its standard stock lines and samples of some of their various specialties. It shall be the purpose of the company's salesmen, with the cooperation of the merchants, to keep the cardboard cupboard replenished with samples, so that the merchants will not suffer the same fate as Mother Hubbard when she went to her cupboard.

## TAPPI and Inter-Society Color Council to Meet

A feature of the annual meeting of the Technical Association of the Pulp and Paper Industry will be its joint meeting with the Inter-Society Color Council at the Roosevelt Hotel on February 21-22, 1940. This program will begin at 2:00 P. M. on Wednesday, February 21st, with a technical session on spectrophotometry in the pulp and paper industry. John L. Parsons of the Hammermill Paper Company and chairman of the TAPPI Optical Properties Committee will preside as chairman. Included in this program are the following subjects:

Survey of Instruments:

1. Survey of Spectrophotometers by K. S. Gibson, National Bureau of Standards.

2. Survey of Abridged Spectrophotometers by J. A. Van den Akker, Institute of Paper Chemistry.

3. Survey of Instruments in Use in the Pulp and Paper Industry (by title).

Use of Instruments:

4. In Pulp by R. S. Hatch, Weyerhaeuser Timber Company.

5. In Beater Furnish by R. N. Griesheimer, Mead Corporation.

6. In Uncoated Paper by Myrl N. Davis, Kimberly Clark Corporation.

7. In Coated Paper by William J. Foote, Consolidated Water Power and Paper Company.

At 8 P. M. there will be a popular session held at the auditorium of the Electrical and Gas Association of New York, 480 Lexington Avenue. Admission to this session will be by ticket only. These may be obtained by sending a stamped self-addressed envelope to the Inter-Society Color Council, Box 155, Benjamin Franklin Station, Washington, D. C. The subject of this session will be The Parade of Color.

At 9:30 A. M. on February 22nd at the Roosevelt, there will be a discussion session under the chairmanship of Deane B. Judd of the National Bureau of Standards. This will be followed by a luncheon and at 2:30 P. M. a business session will be held at which delegates from the member-societies of the council will report.

On February 23rd and 24th the Council will meet jointly with the Optical Society of America and the American Physical Societies at Columbia University.

## To Supply Newsprint for Egypt

It is reported that the Canadian Trade Commissioner in Cairo who cabled his government at the instance of Egyptian Customs Administration, in regard to Egypt's requirements in the way of newsprint paper, has received a cabled reply expressing Canada's readiness to meet these needs, according to a report from the office of the American Commercial Attache, Cairo.

Th reply states that there are 3 paper manufacturing firms in Canada who express their willingness to supply newsprint paper to Egypt and that price lists and other specifications would be submitted immediately. The Director General of the Egyptian Customs Administration is expecting to take the necessary measures to facilitate the importation of newsprint paper from Canada, with a view to assuring a regular supply.

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# Construction News of Pulp and Paper Mills

## Container Corp. of America Begins Improvements To Cost $250,000 At Chicago—Florida Pulp & Paper Co. Drills Test Wells For New Mill At Pensacola, Fla. — Hudson Pulp & Paper Corp. Rebuilds Sulphite Mill.

**Richmond, Va.**—The Western Tablet and Stationery Company, Mitchell avenue and Eleventh street, St. Joseph, Mo., manufacturer of paper specialties, has approved plans for new factory branch, storage and distributing plant at Eighth and Everett streets, Richmond, to be one-story, 120 x 200 feet, estimated to cost about $50,000, including equipment. Contract for erection has been let to Allen J. Saville, Electric Building, Richmond, and work will be placed under way at once. Company is affiliated with the Hopper Paper Company, Taylorville, Ill., manufacturer of bond and other paper stocks, envelopes, etc.

**Chicago, Ill.**—Container Corporation of America, 111 West Washington street, manufacturer of corrugated boxes and containers, has begun an expansion and improvement program at local mill on Ogden avenue. Work will include new buildings for increased capacity in paper board production, including the use of an improved paper-making process, developed to bring about reduced power costs per ton of paper. A new boiler unit will be installed, with rated capacity of 75,000 pounds of steam per hour, to supplement an existing boiler of like rating, with new water-treatment system and other facilities. Entire project is estimated to cost about $250,000, with equipment. Completion is scheduled early in the spring. Company also will make improvements in the water system at its branch mill at Circleville, Ohio, used for straw board manufacture, estimated to cost approximately $30,000. At its branch plant at Nixon and Fountain streets, Philadelphia, Pa., company proposes to install new oil burners in power house, in conjunction with a new service tank and other improvements.

**New York, N. Y.** — The Favorite Paper Box Company, 521 West 25th street, paper boxes and containers, has arranged for lease of space in building at 442-52 West 31st street, extending through to 445-47 West 30th street, totaling about 20,000 square feet of floor space, and will occupy for expansion. Present works will be removed to new location and capacity increased.

**Augusta, Me.**—The Hudson Pulp and Paper Corporation, Maple street, has begun re-building of sulphite pulp mill, recently referred to in these columns, to replace a fire loss. It will be 100 x 130 feet, with structure scheduled to be ready for occupancy early in 1940. Construction contract is being carried out by the James Leck Company, 211 South Eleventh street, Minneapolis, Minn. Cost reported over $60,000, with equipment.

**Pensacola, Fla.**—The Florida Pulp and Paper Company, recently organized to construct and operate a local mill for the manufacture of book, bond and other paper stocks, as previously noted in these columns, has begun the drilling of test wells to determine the extent of water supply for new mill on tract of land secured under lease from the city. Work on the test wells will be carried out under direction of J. S. Seay, Layne Central Company, 1993 Chelsea avenue, Memphis, Tenn., and will be pushed to early completion. Company has preliminary plans under way for initial units of proposed mill, and will proceed with actual erection early in 1940. It is reported to cost over $1,000,000, with equipment. New company is headed by A. D. Pace, Pensacola, and James H. Allen, Savannah, Ga., previously vice-president of the Union Bag and Paper Corporation, New York, with mill at Savannah.

**Detroit, Mich.**—The Motor City Paper Tube Company has been organized with capital of $10,000, to manufacture paper tubes and kindred paper goods. New company will take over and succeed to the concern of same name with plant at 13911-21 Meyers Road. Albert A. Schaerer is the principal incorporator.

**Enka, N. C.**—The American Enka Corporation, manufacturer of viscose rayon products, has approved plans for new addition to local mill, to be one-story, designed primarily for laboratory service. It is reported to cost over $35,000, with equipment. Erection contract has been let to Potter & Shackelford, Inc., Allen Building, Greenville, S. C., and work will be placed under way at once. Main offices of company are at 200 Madison avenue, New York, N. Y.

**Marshall, Minn.**—Clifford Larson, Third street, paper products, has begun construction of a new one-story addition for expansion in storage and distributing facilities. General erection contract has been let to Hess & Sons, Marshall. Cost reported close to $21,000, with equipment.

**New Haven, Conn.**—The New Haven Pulp and Board Company, 259 East street, manufacturer of paper board products, news board, etc., has let general contract to the H. Wales Lines Company, Meriden, Conn., for alterations in plant, and work is being placed under way. No estimate of cost announced.

### New Companies

**New York, N. Y.** — The Vee-Line Paper Corporation has been organized with capital of $20,000, to deal in paper goods of various kinds. New company is represented by B. Robbins, 25 Warren street, New York, attorney.

## To Rebuild Paper Machine at Watervliet

KALAMAZOO, Michigan, December 26, 1939—The Board of Directors of the Watervliet Paper Company have approved plans for the rebuilding of the A paper machine during the coming year, at an estimated cost of $150,000. This machine is the one that the company started operations with in December 1910. This step will speed up production and enable the company to operate on a competitive basis with the other book mills in this area.

## 250th Anniversary

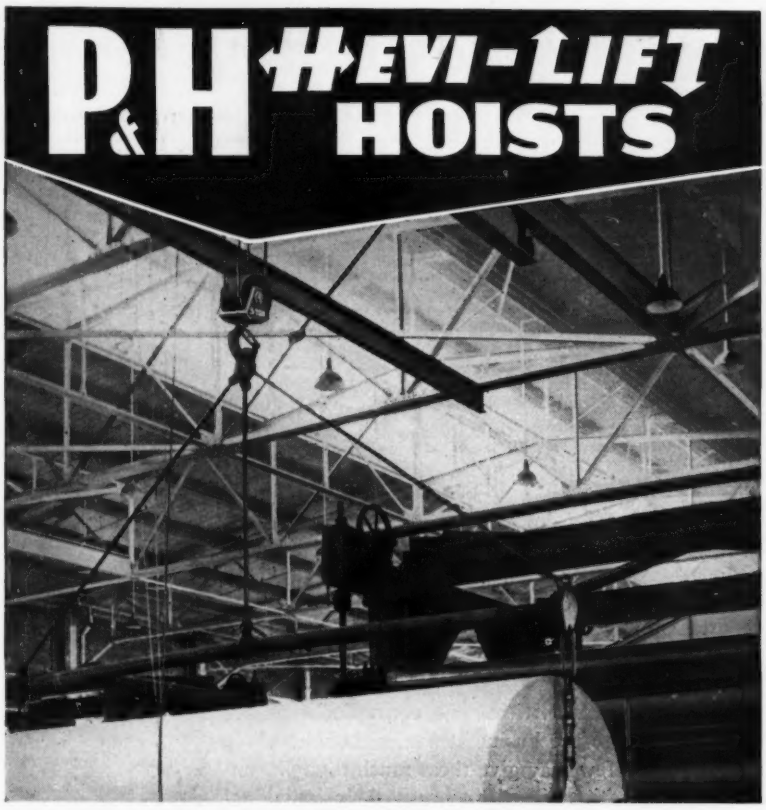
William Bond Wheelwright, chairman of the committee on History and Biography of the Technical Association of the Pulp and Paper Industry, 10 Forest street, Cambridge, Mass., writes: "Two hundred and fifty years ago at this season the Mennonite preacher, William Rittenhouse, had doubtless celebrated with religious fervor the Christmas services, in the small settlement of Germantown, Pa. Perhaps he indulged also in a prayer for the new industry on which he was preparing to embark during the new year. For it was during the year 1690 that, in partnership with the first printer of the Middle Colonies, William Bradford, the corner-stone of the American paper industry was laid.

"Printing had taken root in New England at Cambridge fifty-two years previously, yet for more than a half century no effort had been put forth to manufacture paper, in spite of the fact that twenty-three of the thirty-five or so printers of the colonies were located in or near Boston before the paper mill at Milton was erected in 1728.

"It is all the more remarkable that within five years after the first print shop had been started at Philadelphia by Bradford, that the historic paper mill of Rittenhouse and Bradford was erected. The enterprise and foresight of these two allied craftsmen is all the more to be admired.

"In view of the 250th anniversary of the beginning of papermaking in America, it is the unanimous recommendation of the Committee on History and Biography of the Technical Association of the Pulp and Paper Industry that suitable ceremonies should be held during the year in Philadelphia at the Franklin Institute, and that markers should be erected near the site of the first paper mill and at other points of historic significance to the paper industry during the year 1940.

"The printing industry as it happens, is already well organized to commemorate this coming year—the 500th anniversary of the invention of printing from movable type. A committee of the American Institute of Graphic Arts has already arranged for radio programs and other observances of this anniversary. It would appear that the paper industry was sadly indifferent to its own traditions should it fail to take advantage of the 250th anniversary of American papermaking to do honor to the founders of the industry in America."

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## West Dudley Mill Damaged by Fire

DUDLEY, Mass., December 25, 1939—A fire at the mill of the Rhode Island Card Board Company did $15,000 damage before it was brought under control by firemen from Webster and Southbridge who fought the flames for four hours on December 22. Fire Chief Arthur Belmore of Webster said the fire might have started from spontaneous combustion. Although confined to one room of the plant it destroyed the roof. Each fire department laid five hose lines into the Quinebaug river.

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Editor Technical Section

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Washington Correspondent

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## COMING EVENTS IN PAPER INDUSTRY

NEW ENGLAND SECTION. Technical Association of the Pulp and Paper Industry—Third Friday of each month at the Roger Smith Hotel, Holyoke, Mass.

DELAWARE VALLEY SECTION. Technical Association of the Pulp and Paper Industry—Second Friday of each month at the Engineers Club, Philadelphia, Pa.

LAKE STATES SECTION. Technical Association of the Pulp and Paper Industry—Second Tuesday of each month at the Conway Hotel, Appleton, Wis.

KALAMAZOO VALLEY SECTION. Technical Association of the Pulp and Paper Industry—First Thursday of each month at the Park, American Hotel, Kalamazoo, Mich.

## EXTENSION OF GOVERNMENT CONTROL

All government activities and court decisions are of importance to the business man, although only a comparatively few may give them much thought, unless such activities directly concern their individual business. In former years, and when the Federal Government was administered by a more democratic and a less socialistic policy than has been in effect during the last seven years, business had no particular need to feel concerned about the trend of government. But today the status is much changed. The restrictions imposed upon business by various departments of the Federal Government, and a large number of decisions rendered by the courts are of sufficient importance to be given consideration. They indicate the general trend toward extension of governmental control over business and priority of civil rights over property rights.

A decision by the Court in the Apex case in Philadelphia a few weeks ago denied the power of Congress to protect interstate commerce from interferences arising from a sit-down strike. Another recent court decision which indicates the trend toward government control was the Chicago milk case. In this instance the court in overruling a decision by a lower court, held that cooperative marketing activities are subject to Congressional regulation through the anti-trust laws, despite the power of the Secretary of Agriculture to conclude marketing agreements. The court held that in only specific agreements, fixing prices and marketing methods, could be exempted from the anti-trust act: that cooperative agencies had no general authorization to enter into price-fixing agreements.

The Government in appealing the New River case to the Supreme Court, also revealed this marked trend toward Federal control. The New River in Virginia, is a non-navigable tributary of the navigable Kanawha river. The Federal Power Commission sought to bring under its control to fix rates, security issues, etc., of a hydro-electric project started on the New River several years ago. It was the contention of the Federal Power Commission that it should have jurisdiction over project because the project affected navigation on the Kanawha river. The Fourth Federal Circuit Court denied a further extension of the Government's control over water power, holding that all power to make such regulations was vested in the State and not in the Federal Government, regardless of any indirect interference with navigation. The Governments' appeal is being made to deny the right of the State to control water power and to vest it in Congress, thus giving Federal jurisdiction over water power.

The rapidly increasing extension of Federal control and regulation of business is further shown in some of the Federal Court and Federal administrative decisions during the past two weeks. You can, for instance avoid a Federal Trade Commission prosecution under the anti-trust law if you acquire the assets of the company with which you may wish to merge. The FCC recently dismissed a complaint on the above grounds. It was based on a decision rendered by the Supreme Court which held that the Clayton Act bars a company from acquiring the stock of another company, but does not prohibit the acquisition of assets. Now the Commission has asked that the Act be amended to eliminate this loophole.

Pending a further decision, you can establish a loss for income tax purposes by selling securities to a corporation owned by you and your wife. On a divided decision, the Supreme Court upheld a Circuit Court decision on this point. According to a recent ruling by the United States Court of Claims, an estate tax can be avoided on a large life insurance policy if the proceeds are irrevocably assigned to heirs, who may be required to pay the premiums. If you pay the premiums, however, the court holds that the insurance becomes a part of the taxable estate. Another interesting decision by a New York court permits a business man to use the Robinson-Patman Act as a defense in a civil suit to enforce a contract. A New York seller's agent agreed to split his commission with a buyer and the buyer sued to recover his share in commissions. A New York court held that the seller could defend himself on the ground that the Robinson-Patman Act prohibited such agreements and the contract was, therefore, illegal and void.

Although the Second Court of Appeals has rendered a decision that an employer can refuse to hire union men without violating the Wagner Act, this decision is not expected to stand for long. But, according to the Department of Labor, a business man

cannot hire minors, 16 to 18 years of age, to perform the work of truck drivers or drivers' helpers, providing your business is interstate commerce, the labor Department has ruled, under the Wage and Hour law, that such work is too hazardous for young employees to perform.

At the recent Congress of American Industry, sponsored by the National Association of Manufacturers, opposition was expressed to the Borah-O'Mahoney Federal Licensing Bill, which would enlarge control of the Government over industry. Many business men are keenly aware of the growing extension of Federal control. In the declaration of principles adopted by the Industrial Congress it was stated that Government and industry must work for the continued traditional system of free enterprise. To preserve that free enterprise many of the present faulty laws, such as the Labor Relations Act and the Fair Labor Standards Act, to mention but two of them, must be changed to remove inequalities and provide impartial administration to insure permanent improvement in the relations of business and labor.

## To Increase Lumbering Operations

Lumbering operations by Quebec's important pulp and paper companies are expected to be appreciably expanded during the current winter season, according to a report from Consul J. I. Touchette, Montreal, made public by the Department of Commerce.

One large company has already announced that it will increase its cut by about 60 per cent and employ approximately 4,000 men in its forest operations.

Canadian October newsprint output, of which over 50 per cent was produced in the Province of Quebec, were on a larger scale than for any month since the end of 1937.

Prior to September, Canadian newsprint mills had been operating at about 65 per cent of capacity, a figure which has now been raised to 77.5 per cent. As operating expenses have not greatly increased and as mills supplying the American market quote in American dollars today, gaining a premium of 10 per cent under the Canadian exchange control system, prospects in the local pulp industry are bright.

## St. Regis May Install Machine

[FROM OUR REGULAR CORRESPONDENT]

DEFERIET, N. Y., December 26, 1939—Announcement is made here that another paper machine is to be installed in the local branch of the St. Regis Paper Company in accordance with expansion plans. Plans call for the removal here of a large machine from the Raymondville branch which was closed some time ago. At present workmen are arranging a location for the machine. There is a vacant space 125 by 60 feet, between the present two pairs of machines at the local plant where the fifth machine will probably be installed. Workmen are now erecting a roof over the space and will have everything in readiness in the event mill officials decide to install the additional machine. If the plans do not mature and the machine is not moved here it is probable that the space will be used for storage purposes.

## Production Ratio Report

These statistics are based upon paper production reports to the American Paper and Pulp Association.

COMPARATIVE MONTHLY SUMMARIES[1]

| Months | 1939 | 1938 | 1937 | 1936 | 1935 | 1934 |
|---|---|---|---|---|---|---|
| January | 77.5% | 63.9% | 90.3% | 76.1% | 65.8% | ..... |
| February | 81.7% | 68.7% | 90.1% | 77.9% | 70.0% | ..... |
| March | 84.0% | 69.6% | 90.3% | 76.0% | 70.5% | ..... |
| April | 82.9% | 68.3% | 92.1% | 82.3% | 70.0% | ..... |
| May | 80.2% | 69.0% | 90.6% | 81.6% | 69.4% | ..... |
| June | 79.7% | 66.0% | 87.3% | 80.7% | 72.3% | ..... |
| July | 75.2% | 72.0% | 81.8% | 77.3% | 64.9% | ..... |
| August | 82.9% | 77.2% | 82.9% | 81.5% | 70.9% | ..... |
| September | 88.7% | 76.3% | 78.6% | 80.5% | 71.9% | 58.2% |
| October | 96.6% | 82.5% | 73.5% | 87.6% | 75.6% | 64.7% |
| November | 97.6% | 79.6% | 61.9% | 88.0% | 75.3% | 61.7% |
| December | ..... | 74.4% | 54.5% | 85.9% | 71.2% | 59.6% |
| Year Average | ..... | 72.3% | 80.6% | 81.3% | 70.5% | ..... |
| First 50 weeks | 84.8% | 72.4% | 82.0% | 81.6% | 70.7% | ..... |

COMPARATIVE WEEKLY SUMMARIES

| CURRENT WEEKS, 1939 | | CORRESPONDING WEEKS, 1938 | |
|---|---|---|---|
| November 11 | 98.1% | November 12 | 80.9% |
| November 18 | 98.4% | November 19 | 81.6% |
| November 25 | 97.3% | November 26 | 74.4% |
| December 2 | 96.0% | December 3 | 78.8% |
| December 9 | 97.3% | December 10 | 77.6% |
| December 16 | 97.2% | December 17 | 81.3% |

The following statistics show the number of mills reporting by ratio groups:

| | Number of Mills Reporting—Current Weeks | | | | | |
|---|---|---|---|---|---|---|
| Ratio Limits | Nov. 11, 1939 | Nov. 18, 1939 | Nov. 25, 1939 | Dec. 2, 1939 | Dec. 9, 1939 | Dec. 16, 1939 |
| 0% to 50% | 33 | 30 | 38 | 40 | 30 | 25 |
| 51% to 100% | 273 | 276 | 263 | 253 | 249 | 129 |
| Total Mills Reporting | 306 | 306 | 301 | 293 | 279 | 154 |

PAPERBOARD OPERATING RATIOS

Per cents of operation based on "Inch-Hours" reported to the National Paperboard Association.

| Year | Jan. | Feb. | Mar. | Apr. | May | June | July |
|---|---|---|---|---|---|---|---|
| 1935 | 62% | 68% | 68% | 63% | 61% | 66% | 62% |
| 1936 | 62% | 67% | 67% | 70% | 69% | 70% | 69% |
| 1937 | 80% | 86% | 86% | 88% | 85% | 77% | 66% |
| 1938 | 54% | 60% | 61% | 57% | 58% | 56% | 57% |
| 1939 | 60% | 67% | 71% | 69% | 64% | 67% | 63% |

| Year | Aug. | Sept. | Oct. | Nov. | Dec. | Year Avg. |
|---|---|---|---|---|---|---|
| 1935 | 67% | 71% | 77% | 71% | 61% | 66% |
| 1936 | 75% | 78% | 82% | 80% | 74% | 72% |
| 1937 | 74% | 69% | 65% | 55% | 45% | 73% |
| 1938 | 66% | 66% | 70% | 65% | 59% | 61% |
| 1939 | 72% | 74% | 84% | .... | .... | .... |

Week end. Nov. 11, 1939—84%
Week end. Nov. 18, 1939—83%
Week end. Nov. 25, 1939—78%
Week end. Dec. 2, 1939—78%
Week end. Dec. 9, 1939—79%
Week end. Dec. 16, 1939—79%

[1] Production-capacity ratios are based upon six-day capacity ratings which are adjusted periodically to correspond with the ratings reported by individual companies. Ratios are subject to revision until all reports are received.

## To Represent Mills in South America

KALAMAZOO, Michigan, December 20, 1939—Robert L. Harrington who has been associated with his father, Ray W. Harrington in charge of the Chicago office of the Hawthorne Paper Company, sailed December 1 for South America. He will represent a number of non-competitive mills, including Bryant Paper Company, Hawthorne Paper Company, C. A. Hubbard, and Mid-States Gummed Paper Company, of the Middle West and Franklin Paper Company, Strathmore Paper Company, and others in the East.

Mr. Harrington attended the University of Madrid, speaks Spanish fluently and has a thorough knowledge of the ways and customs of Spanish speaking people.

He expects to establish a permanent office in Buenos Aires and from there will contact all principal cities in the various South American Republics. Mr. Harrington has organized a company and incorporated under the name of Robert L. Harrington Corporation.

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**ZINC SULFIDE PIGMENTS IN PAPER**

Section of the
Technical Association of the Pulp and Paper Industry

Edited by Ronald G. Macdonald, Secretary

# The Absorption of Sulphur Dioxide In Water*

By L. C. Jenness[1] and J. G. L. Caulfield[2]

**Abstract**

*Coefficients of absorption of sulphur dioxide in water have been determined in a tower packed with one-inch Raschig rings, covering an approximate range of liquor velocity from 0.09 feet per minute to 0.69 feet per minute, with gas velocities varying from 0.037 feet per second to 0.30 feet per second. The coefficient was found to vary at fixed liquor velocities as a power function of the gas velocity, the exponent occurring at higher gas velocities. The coefficient was also found to vary as a power function of the liquor velocity at fixed gas velocities, with higher values of the exponent of the gas velocity increasing at higher gas velocities. Resistance to absorption was found to be appreciably in the liquid film at low liquid velocities, but to shift to the gas film at high liquid velocities. The data are compared with that of Adams (3) and of Reiley (4).*

A number of values of the coefficient of absorption of $SO_2$ in water have appeared in the literature, covering a variety of tower packing materials, and a wide range of liquid velocities, gas velocities and temperatures *(1, 2, 3, 4)*. The theory of the absorption of a gas in a liquid, based upon the two-film conception first proposed by Whitman *(5)* need only be very briefly stated, having been amply reviewed in previous publications and discussed at length in the standard texts *(6, 7, 8, 9)*. In the briefest terms, when a gas is in contact with a liquid in which it is more or less soluble, a particle of gas entering solution in the main body of liquid must pass through two stagnant films, one of gas and the other of liquid. The two films are considered to be at equilibrium at their plane of contact, so that a concentration gradient will exist between the main body of liquid and the interface and a partial pressure gradient between the main body of gas and the interface. The gradients constitute the driving forces in absorption, and may be expressed in terms of either liquid concentrations or partial pressures. Depending upon the degree of solubility of the gas being absorbed, the resistance to absorption may be mainly in one of the films or may be distributed between the two films. It is generally agreed that, in the case of a very soluble gas, the resistance is principally in the gas film, while with relatively insoluble gases the resistance is largely in the liquid film. Sulphur dioxide is supposed to occupy an intermediate position, and the resistance to its absorption is considered to be divided between the two films, the distribution depending upon such circumstances as relative liquid and gas velocities, temperature, etc.

### General Rate Equation in Integrated Form

The general rate equation for absorption of a gas, expressing the driving force in partial pressure units may be expressed in integrated form, if Henry's law is assumed to apply to the system, as

$$\frac{W}{\theta} = K_G \, a \, V \, \Delta P_m$$

where: $\frac{W}{\theta}$ = pounds of gas absorbed per hour.

$K_G$ = the overall coefficient of absorption, pounds per hour per square foot per atmosphere of $SO_2$ partial pressure difference between gas and liquid.

$a$ = square feet of surface per cubic foot of packing.

$V$ = packed volume, cubic feet.

$\Delta P_m$ = logarithmic average driving force, atmospheres of $SO_2$ partial pressure difference between gas and liquid at gas entrance and exit.

The assumption of Henry's law is often made in the case of sulphur dioxide and water, and is sufficiently valid for relatively high leaving concentrations of gas. Its application to the low exit gas concentrations met with in the present investigation leads to serious error, due to the fact that sulphur dioxide solutions fall far short of obeying Henry's law at very low concentrations, the curve expressing equilibrium values of vapor pressure and liquid concentrations being decidedly concave upward. When the gas stream is so nearly completely stripped of soluble constituent as in the data here presented, the driving force, or difference between the actual partial pressure of sulphur dioxide in the gas mixture and the equilibrium partial pressure from the liquid stream, is greater than that indicated by the assumption of Henry's law. In consequence abnormally large coefficients will be obtained. For the range of entrance and exit concentration covered here the use of the integrated equation would lead to coefficients from 10 to 30 per cent larger than their true values. The coefficients were consequently calculated by graphic integration of the equation *(8)*.

* Presented at the Fall Meeting of the Technical Association of the Pulp and Paper Industry, Hotel Syracuse, Syracuse, N. Y., Sept. 12-14, 1939.

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[2] Assistant Professor of Pulp and Paper Technology, University of Maine, Orono, Maine.

$$\int_{y_2}^{y_1} \frac{(1+y)\,(1+y_1)dy}{(y-y_1)} = \int_{V}^{O} \frac{\pi K_G\, a\, d\, V}{G}$$

where: $y$ = gas concentration, pound mols soluble gas per pound mol of inert gas.
$y_1$ = gas concentration in equilibrium with liquid phase, pound mols soluble gas per pound mol of inert gas.
$\pi$ = total pressure, atmospheres.
$K_G$ = overall coefficient of absorption, pound mols per hour per square foot per atmosphere partial pressure difference of $SO_2$ between gas and liquid.
$a$ = square feet of surface per cubic foot of packing.
$V$ = packed volume of tower, cubic feet.
$G$ = pound mols of inert gas per hour.

The use of the above relation makes no assumption as to the applicability of Henry's law and may be graphically integrated from solubility data by plotting assumed values of y against,

$$\frac{(y-y_1)}{(1+y)\,(1+y_1)}$$

### Apparatus

The apparatus Fig. 1 employed was that permanently installed for class instruction in gas absorption in the Chemical Engineering Laboratory of the University of Maine, and consisted of a hard lead tower (1) six inches in internal diameter and packed with one inch clay Raschig rings to a depth of 19 inches. Water was supplied through a calibrated orifice (2), across which was connected a mercury filled manometer, the water line terminating in a spray head directly above the top of the packing. This arrangement of water supply was modified in certain of the runs where the water temperature was too high for the range desired, cooled water being pumped to a head box and the rate of flow to the tower determined by direct weighing of the tower effluent. The gas mixture was admitted at the bottom of the tower (3) to a short unpacked section from the bottom of which the effluent was led off through a liquid seal. The air and residual sulphur dioxide were led from the top of the tower to a duct (4) connecting with the ventilation fans. Sulphur dioxide was supplied from a cylinder of compressed gas (5), its rate of admission being kept constant by means of a mercury filled manometer (6). The carrier gas, air, was obtained from a small compressor through the receiver (7). The volume of air was measured by a dry gas meter (8). Inlet and exit gas concentrations were determined by the absorption of the sulphur dioxide content of a sample of each stream in standard iodine with

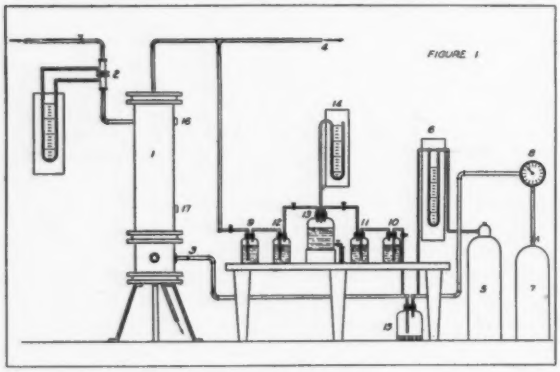


Fig. 1.

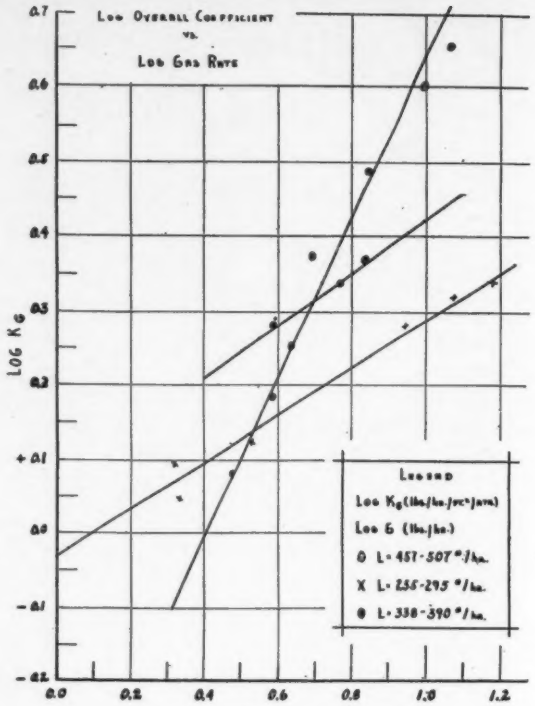


Fig. 2.

starch as an indicator in two bottles (9) (10), followed by two more bottles (11) (12) containing a trace of iodine and starch to serve as a check upon the complete removal of sulphur dioxide in the previous bottles. The inert gas content of the gas stream was measured by the volume of water aspirated from a bottle (13) which was put under a slight vacuum before a gas sample was taken and returned to the same vacuum after analysis, pressure adjustment being regulated by means of a water filled manometer (14). The gases were mixed and saturated in a bottle (15) before sampling and leading to the tower. Two openings in the tower (16) (17) served as thermometer wells and as manometer connections for determination of the total pressure in the tower.

### Experimental

In determining the value of the overall coefficient of absorption the sulphur dioxide—air mixture, adjusted to the desired concentration, was admitted to the bottom of the tower and water allowed to flow in at the top at the proper rate. When the system had reached equilibrium, readings were taken of air rate and water rate, and the inlet and outlet gas streams were analyzed over a period of time sufficient to insure steady conditions. Pressure and temperature readings were taken at the point at which the gas was analyzed and in the tower. Temperature in the tower varied from 10 to 16 deg. C., superficial gas velocity from .037 to 0.30 ft. per sec., and superficial water velocity from 0.09 to 0.69 ft. per min. Inlet gas varied from 10.9 to 18.9 per cent $SO_2$ by volume. The ranges of both gas and liquid velocities covered were as wide as the limitations of the apparatus would permit. The tower effluent was not analyzed, it being felt that more reliable values could

be obtained, by basing all analyses on the gas stream. The method of gas analysis here employed proved both sensitive and rapid, and appeared to the authors to be preferable to the use of an Orsat apparatus.

### Discussion of Data

In Table I are presented all of the data accumulated, values of L and G being tabulated in various units to facilitate comparison with data from other sources. The writers have chosen as units for these variables to be employed in subsequent discussion:

$K_G$ = pounds $SO_2$ per hour per square foot per atmosphere $SO_2$ partial pressure difference
L = pounds $H_2O$ per hour
G = pounds dry air per hour.

Figure 2 was plotted from the data of Table II and represents log $K_G$ versus log G for three ranges of liquor velocity, 255-295 lb. per hr., 338-390 lb. per hr. and 457-507 lb. per hr. Each of the lines shown is expressible by the general equation,

$$K_G = b\ G^n$$

where $K_G$ = overall coefficient of absorption, pounds per hour per square foot per atmosphere $SO_2$ partial pressure difference
b = a constant
G = pounds dry air per hour, or gas velocity
n = a constant

If n is evaluated from the slopes of the lines it is found to be 1.08 for a liquor rate of 457-507 lb. per hr., 0.36 for a liquor rate of 338-390 lb. per hr., and 0.32 for a liquor rate of 255-295 lb. per hr. It will be seen that, in general, the slopes of the lines of Fig. 2 or the exponents in the equation of the lines,

$$K_G = b\ G^n$$

increase with increasing liquor velocity. This may be interpreted as a result of increased turbulence in the liquid film, since nearly the same range of gas velocity is covered in each liquor range.

In Table III are shown values of $K_G$ and G as experimentally determined, values of $K_G$ corrected to a constant gas velocity by means of the exponents calculated from Fig. 2 and the equation,

$$K_G = b\ G^n$$

and the liquor rates at which these experimental values of $K_G$ were determined. The logarithms of both experimental and corrected values of $K_G$, and the logarithms of L are also tabulated, and are plotted as log $K_G$ versus log L in Fig. 3. It will be noted that the lower portions of two of the three curves shown are dotted in the lowest ranges of liquor velocity, where it appears that changes of liquor velocity have no effect upon the magnitude of the coefficient. A possible explanation of the failure of increased velocity of liquid to increase the coefficient in this range may be that, at such low rates of liquid supply, a condition approaching viscous flow exists, which does not merge into turbulent flow until the solid portions of the curves are reached. The increased coefficient at which the flat portion of the middle curve occurs may possibly be due to thinning of the liquid film by the action of the gas stream, the velocity of which is greater than in the bottom curve. With such a packing material as one-inch rings dumped at random it is virtually impossible to predict at what values of L the flow would be viscous and at what values it would be turbulent. If the occurrence of the flat portion of the curves can be explained by the type of liquid flow, the transition from one type of flow to another would appear to be at a value of L of about 262 lb. per hour.

Comparing the slopes of the three curves of Fig. 3, it will be noted that the slope of the curve corresponding to the highest gas rate is much steeper than the slopes of the two lower curves, while all three curves are over the same range of liquor velocity. This may be taken as further evidence of the possibility of the gas stream inducing turbulence in the liquid film and thereby reducing its resistance. This is borne out by comparison with the data of Adams *(3)* and Reiley *(4)* to be presented further on in the discussion. Sherwood *(9)* notes that plots of $K_G$ *vs.* L tend to level off as higher liquor rates

TABLE I.—OPERATING DATA

| Run no. | $K_G$ lb./hr./sq. ft./atm.) | Air velocity, lb. per hr. | Air velocity, lb. mols per hr./sq. ft. | G,* ft. per sec. | Liquor velocity, lb. per hour | Liquor velocity, lb. mols per hr./sq. ft. | Liquor velocity, ft. per min. | $SO_2$ In, per cent | $SO_2$ Out, per cent |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.69 | 5.64 | 0.991 | 0.116 | 65 | 18.4 | .088 | 10.9 | 3.90 |
| 2 | 1.09 | 4.73 | 0.831 | 0.102 | 133 | 37.8 | .181 | 15.0 | 4.02 |
| 3 | 1.58 | 5.73 | 1.012 | 0.125 | 180 | 50.9 | .245 | 14.8 | 3.00 |
| 4 | 1.42 | 4.63 | 0.815 | 0.098 | 239 | 67.6 | .325 | 13.3 | 1.56 |
| 5 | 1.08 | 2.52 | 0.442 | 0.056 | 243 | 68.7 | .330 | 15.8 | 0.75 |
| 6 | 1.90 | 8.72 | 1.531 | 0.181 | 255 | 72.1 | .347 | 12.0 | 3.30 |
| 7 | 2.09 | 11.80 | 2.070 | 0.240 | 262 | 74.1 | .356 | 11.1 | 2.89 |
| 8 | 1.25 | 2.09 | 0.367 | 0.047 | 271 | 76.6 | .368 | 17.4 | 0.21 |
| 9 | 2.20 | 13.22 | 2.322 | 0.265 | 273 | 77.1 | .371 | 11.8 | 4.53 |
| 10 | 1.11 | 2.15 | 0.378 | 0.049 | 275 | 77.7 | .374 | 18.3 | 0.15 |
| 11 | 1.33 | 3.34 | 0.587 | 0.076 | 295 | 83.4 | .401 | 18.6 | 1.11 |
| 12 | 2.18 | 5.79 | 1.016 | 0.122 | 338 | 95.5 | .460 | 12.8 | 0.90 |
| 13 | 2.34 | 6.83 | 1.200 | 0.144 | 360 | 101.8 | .490 | 17.5 | 1.87 |
| 14 | 1.91 | 3.86 | 0.678 | 0.087 | 390 | 110.0 | .530 | 16.6 | 0.54 |
| 15 | 4.54 | 11.62 | 2.042 | 0.240 | 457 | 129.1 | .622 | 12.4 | 1.39 |
| 16 | 4.01 | 9.37 | 1.646 | 0.197 | 460 | 130.0 | .625 | 13.7 | 0.59 |
| 17 | 1.52 | 3.83 | 0.673 | 0.083 | 465 | 131.3 | .632 | 14.1 | 0.78 |
| 18 | 1.22 | 3.06 | 0.538 | 0.066 | 466 | 131.6 | .634 | 16.0 | 1.04 |
| 19 | 2.36 | 4.88 | 0.856 | 0.106 | 475 | 134.2 | .646 | 18.9 | 0.63 |
| 20 | 3.08 | 6.92 | 1.218 | 0.150 | 476 | 134.3 | .647 | 16.8 | 0.67 |
| 21 | 1.78 | 4.29 | 0.754 | 0.039 | 507 | 143.0 | .690 | 14.0 | 0.45 |

* Velocity of air at the bottom of the tower.

TABLE II.—OVERALL COEFFICIENT VS. GAS VELOCITY

| Run no. | Liquor range, lb./hr. | $K_G$, lb./hr./sq. ft./atm. | G, lb./hr. | Log $K_G$ | Log G |
|---|---|---|---|---|---|
| 6 | 255-295 | 1.90 | 8.72 | .279 | 0.941 |
| 7 | 255-295 | 2.09 | 11.80 | .320 | 1.072 |
| 8 | 255-295 | 1.25 | 2.09 | .097 | 0.320 |
| 9 | 255-295 | 2.20 | 13.22 | .342 | 1.180 |
| 10 | 255-295 | 1.11 | 2.15 | .046 | 0.332 |
| 11 | 255-295 | 1.33 | 3.34 | .124 | 0.524 |
| 12 | 338-390 | 2.18 | 5.79 | .338 | 0.762 |
| 13 | 338-390 | 2.34 | 6.83 | .370 | 0.834 |
| 14 | 338-390 | 1.91 | 3.86 | .281 | 0.586 |
| 15 | 457-507 | 4.54 | 11.62 | .657 | 1.065 |
| 16 | 457-507 | 4.01 | 9.73 | .604 | 0.988 |
| 17 | 457-507 | 1.52 | 3.83 | .182 | 0.584 |
| 18 | 457-507 | 1.22 | 3.06 | .068 | 0.486 |
| 19 | 457-507 | 2.36 | 4.88 | .373 | 0.689 |
| 20 | 457-507 | 3.08 | 6.92 | .488 | 0.840 |
| 21 | 457-507 | 1.78 | 4.29 | .251 | 0.632 |

TABLE III.—ACTUAL AND CORRECTED COEFFICIENTS VS. LIQUOR VELOCITY

| Run no. | Actual coeff. $K_G$ in lb./hr./sq. ft./atm. | actual gas rate G lb./hr. | $K_G$ corrected in constant G | | Liquor rate lb./hr. | Logarithms corr. $K_G$ | Logarithms L |
|---|---|---|---|---|---|---|---|
| 2 | 1.09 | 4.73 | 1.09 | 4.73 | 133 | .038 | 2.124 |
| 4 | 1.42 | 4.63 | 1.42 | 4.63 | 239 | .152 | 2.379 |
| 11 | 1.33 | 3.34 | 1.48 | 4.68 | 295 | .170 | 2.470 |
| 13 | 2.34 | 6.83 | 1.75 | 4.68 | 360 | .243 | 2.556 |
| 19 | 2.36 | 4.88 | 2.26 | 4.68 | 475 | .354 | 2.677 |
| 1 | 1.69 | 5.64 | 1.69 | 5.64 | 65 | .228 | 1.813 |
| 3 | 1.58 | 5.73 | 1.58 | 5.73 | 180 | .200 | 2.255 |
| 6 | 1.90 | 8.72 | 1.66 | 5.73 | 255 | .220 | 2.406 |
| 11 | 1.33 | 3.34 | 1.60 | 5.73 | 295 | .204 | 2.470 |
| 12 | 2.18 | 5.79 | 2.18 | 5.79 | 338 | .339 | 2.529 |
| 14 | 1.91 | 3.86 | 2.20 | 5.73 | 390 | .342 | 2.591 |
| 16 | 4.01 | 9.37 | 2.36 | 5.73 | 460 | .373 | 2.663 |
| 21 | 1.78 | 4.29 | 2.46 | 5.73 | 507 | .391 | 2.705 |
| 6 | 1.90 | 8.72 | 1.90 | 8.72 | 255 | .278 | 2.407 |
| 12 | 2.18 | 5.79 | 2.53 | 8.72 | 338 | .404 | 2.529 |
| 14 | 1.91 | 3.86 | 2.56 | 8.72 | 390 | .408 | 2.591 |
| 20 | 3.08 | 6.92 | 3.94 | 8.72 | 457 | .596 | 2.678 |
| 21 | 1.78 | 4.29 | 3.83 | 8.72 | 507 | .583 | 2.705 |

are reached with the types of packing which allow more or less parallel flow of liquid and gas (spiral tile, wood grids, and partition rings, presumably stacked). However with 1¼ to 1¾-inch quartz, a type of packing nearer to the one-inch rings used in this investigation, a steady increase in $K_G$ is observed with increased L. The curve reproduced for the quartz packing might conceivably flatten out at low values of L, as did those here presented, although the points shown in the reference are not sufficiently numerous to make this point clear.

In the absorption of a gas such as sulphur dioxide, where the resistance to absorption may be divided between the liquid and gas films, it is of interest to determine under what conditions the principal resistance lies in the gas film and under what conditions in the liquid film. This is usually done *(1)* by plotting as $\frac{1}{K_G}$ *vs.* $\frac{1}{\phi G^{.8}}$ the equation representing the relation between overall and film coefficients,

$$\frac{1}{K_G} = \frac{1}{H k_L} + \frac{1}{k_G} = \frac{1}{H k_L} + \frac{1}{\phi G^{.8}}$$

where $K_G$ = overall coefficient.
$H$ = Henry's Law constant.
$k_L$ = individual liquid film coefficient.
$k_G$ = individual gas film coefficient.
$\phi G^{.8}$ = function of gas velocity.

If no intercept occurs on the $\frac{1}{K_G}$ coordinate then the value of the term $\frac{1}{H k_L}$ must be negligible and all of the resistance must lie in the gas film. If an intercept appears, then an appreciable part of the total resistance is in the liquid film. The exponent 0.8 is used because it was found *(2)* that, with gas film controlling, the overall coefficient varied as the 0.8 power of the gas velocity in a wetted-wall tower, where liquid film resistance could not be appreciably affected by gas velocity. Fig. 4, plotted from the data of Table IV shows three curves, one for each range of liquor velocity studied. The curves of liquor velocity of 255-295 lb. per hr. and liquor velocity of 338-390 lb. per hr. gives considerable intercepts on the $\frac{1}{K_G}$ axis indicating appreciable resistance in the liquid film, but a resistance which decreases as liquor velocity increases. The curve representing a liquor velocity of 457-507 lb. per hr. gives a small negative intercept, indicating the disappearance of liquid film resistance and shift of control to the gas film.

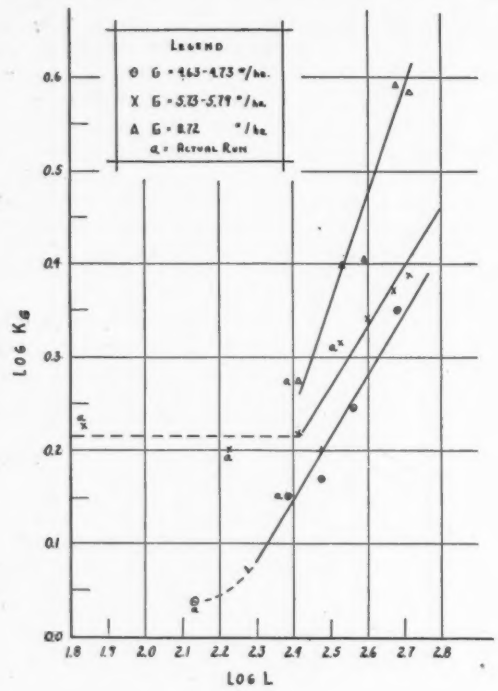


FIG. 3.
Log $K_G$ vs. Log Liquor Rate

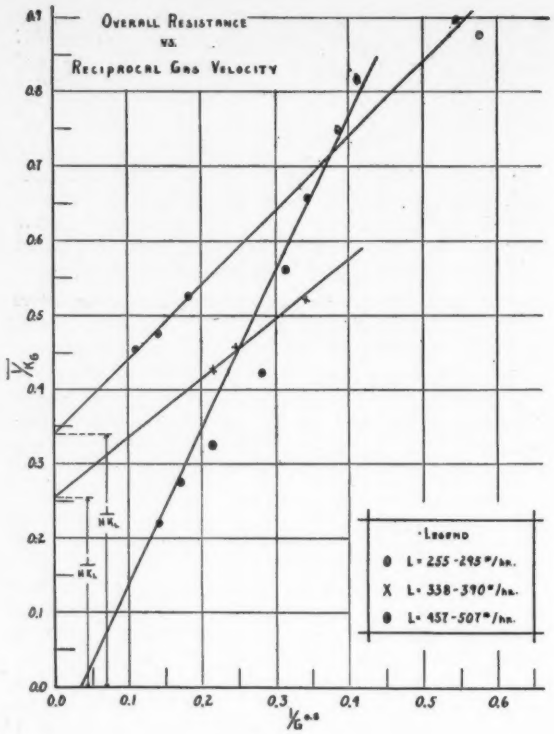


FIG. 4.

TABLE IV.—RECIPROCAL COEFFICIENTS VS. RECIPROCAL GAS RATE TO 0.8 POWER

| Run no. | Coefficient $K_G$ lb./hr./ sq. ft./atm. | $\frac{1}{K_G}$ | Gas Rate G lb./hr. | $G^{0.8}$ | $\frac{1}{G^{0.8}}$ | Liquor range lb./hr. |
|---|---|---|---|---|---|---|
| 6 | 1.90 | .526 | 8.72 | 5.65 | .177 | 255–295 |
| 7 | 2.09 | .478 | 11.80 | 7.25 | .138 | |
| 8 | 1.25 | .880 | 2.09 | 1.75 | .572 | |
| 9 | 2.20 | .454 | 13.22 | 9.30 | .108 | |
| 10 | 1.11 | .900 | 2.15 | 1.85 | .540 | |
| 11 | 1.33 | .752 | 3.34 | 2.62 | .382 | |
| 12 | 2.18 | .458 | 5.79 | 4.08 | .245 | 338–390 |
| 13 | 2.34 | .427 | 6.83 | 4.68 | .214 | |
| 14 | 1.91 | .522 | 3.86 | 2.95 | .339 | |
| 15 | 4.54 | .220 | 11.62 | 7.12 | .140 | 457–507 |
| 16 | 4.01 | .279 | 9.37 | 5.90 | .170 | |
| 17 | 1.52 | .658 | 3.83 | 2.93 | .341 | |
| 18 | 1.22 | .819 | 3.06 | 2.45 | .408 | |
| 19 | 2.36 | .423 | 4.88 | 3.57 | .280 | |
| 20 | 3.08 | .325 | 6.92 | 4.71 | .213 | |
| 21 | 1.78 | .562 | 4.29 | 3.20 | .313 | |

Table V consists of a tabulation of exponential values n that the authors obtained experimentally or calculated by the use of the equa-

tion $K_G = b\ G^n$ and $K_G = c\ L^n$ with some values obtained by other investigators in a somewhat similar manner. The tabulation also includes the gas and liquor velocities used, type of packing and qualitative conclusions in regard to relative film resistances to absorption. The values of inert gas velocity at the bottom of the tower may be slightly in error due to the lack of some information on partial pressures and gas composition.

It is observed from Table V that with Raschig rings any appreciable liquid film resistance disappears at much lower liquid and gas velocities than with wood grids and at somewhat lower values than with 3-in. spiral tile. This effect is probably due not only to increased turbulence of the liquor in its own right but accompanying turbulence induced by the gas velocity which would be expected to be in the descending order of Raschig rings, spiral tile and wood grids from the type of countercurrent flow that would exist in each of the three towers. That is, with wood grid packing the necessary velocities to eliminate liquid film resistance are about a three-fold increase of liquor rate and 12-15 fold increase of gas rate over those for Raschig rings. With spiral tile liquid film resistance was not eliminated at appreciably higher gas rates over substantially the same liquor rates as those at which it disappeared with Raschig rings. It will be observed that some time before the disappearance of the liquid film resistance the exponent n of G is progressively larger (.36, .57, and 1.26) for the rings, tile and wood grids, respectively, which is also the order of gas velocity at which the disappearance would occur. Since in this region the major part of the overall resistance will be in the gas film it is reasonable that the higher gas rates at which the transition occurs would cause a more rapid change in the coefficient.

It is further noticed from Table V that in the presence of a liquid film resistance and substantially the same liquor range the value of the exponent n of L, namely 1.15, is larger for the rings than the value 0.89 for tile in spite of the fact that the latter was evaluated at a higher average gas velocity. This result is very likely due in part to greater turbulence induced in the liquid from the gas with the Raschig rings. Although the value of 1.42 for wood grids might be considered contradictory evidence to the idea of induced turbulence, it is to be recognized that it is only a little larger than 1.15 for the rings and was obtained at much higher gas and liquor velocities in a doubtful range of appreciable liquid film resistance.

### Summary

In the absorption of sulphur dioxide at moderately low liquid and gas velocities the resistance to absorption in the liquid film is appreciable.

When the packing material is one-inch Raschig rings the disappearance of liquid film resistance takes place at a liquor rate of approximately 1510 lb. per hr. per sq. ft., which is a lower superficial velocity than values reported in the literature for spiral tile and wood grids.

With this packing material the value of the coefficient of absorption is substantially independent of liquor velocity at low liquor velocities. At higher liquor velocities the coefficient is found to vary from the 0.64 to the 1.15 power of the liquor velocity.

The variation of the coefficient in the presence of appreciable liquid film resistance, with a given range of liquor velocity, is dependent upon the gas velocity.

TABLE V—EXPONENTS OF GAS AND LIQUOR VELOCITIES vs. GAS AND LIQUOR VELOCITIES

| Author | Type Packing | Major Film Resistance | Exponent n log plot of $G^n$ | Exponent n log plot of $L^n$ | G * ft./sec. | L ft./min. |
|---|---|---|---|---|---|---|
| Reiley (4) | Wood grids | Liquid (appreciable) | 1.26 | ... | 1.4–2.0 | 1.5 |
| " | " | Gas | 2.11 | ... | 1.5–2.1 | 2.0 |
| " | " | " | 2.17 | ... | 1.7–2.2 | 2.5 |
| " | " | " | 2.26 | ... | 1.4–2.2 | 3.0 |
| " | " | ..... | ... | 1.42 | 1.71 | 1.5–3.0 |
| Adams (3) | Spiral tile | Liquid (appreciable) | 0.57 | ... | .17–.39 | 0.68 |
| " | " | " | ... | 0.89 | .14–.40 | .04–.90 |
| Caulfield and Jenness | Raschig rings 1-in. | Gas | 1.08 | ... | .06–.25 | .62–.70 |
| " | " | Liquid (appreciable) | 0.36 | ... | .08–.15 | .46–.53 |
| " | " | " | 0.32 | ... | .04–.29 | .35–.40 |
| " | " | | | 0.67 | .06 | .27–.70 |
| " | " | " | ... | 0.64 | .09 | .27–.70 |
| " | " | | | 1.15 | .18 | .27–.70 |

* Velocity of inert gas at the bottom of the tower.

### Literature Cited

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(2) Haslam, Hershey, and Kean, *Ind. Eng. Chem.*, 16, 1224, (1924).
(3) Adams, *Ind. Eng. Chem.*, 25, 424, (1933).
(4) Reiley, *Tech. Assoc. Papers*, 22: 527, (1938).
(5) Whitman, *Chem. Met. Eng.*, 29, 147, (1923).
(6) Walker, Lewis, McAdams, and Gilliland, "Principles of Chemical Engineering," New York, McGraw-Hill Book Co., 1937.
(7) Badger and McCabe, "Elements of Chemical Engineering," New York, McGraw-Hill Book Co., 1936.
(8) Perry, Chemical Engineers' Handbook, New York, McGraw-Hill Book Co., 1934.
(9) Sherwood, "Absorption and Extraction," New York, McGraw-Hill Book Co., 1937.

## TAPPI Notes

The Pacific Section of the Technical Association of the Pulp and Paper Industry will meet at the Hotel Winthrop, Tacoma, Wash., on January 9.

Charles di Carlo, formerly of the Wausau Paper Mills, is now plant chemist of the Upson Company, Lockport, N. Y.

B. M. Kimball has returned as general manager of the Gilman Paper Company, Gilman, Vt. He was recently with the Hollingsworth & Whitney Company.

Engelbert Kirchels is now superintendent of the Hurlbut Paper Company, South Lee, Mass.

A. W. Pesch is now general superintendent of the Southern Kraft Corporation, Georgetown, S. C., having been transferred from Panama City, Fla.

W. L. Cassiday, formerly of the Cornell Wood Products Company, is now pulp and paper instructor for the Michigan State Department of Vocational Education, Port Huron, Mich.

H. D. Helder is now mill manager of the Canton N. C. Division of the Champion Paper and Fibre Company.

G. W. Coggeshall, who has been engaged in research for the past fifty years, has retired from service with the S. D. Warren Company, Cumberland Mills, Me. Dr. Coggeshall will take a five months' vacation in California and the Southwest.

## Delaware Valley TAPPI to Meet

The Delaware Valley Section of the Technical Association of the Pulp and Paper Industry will meet at the Engineers Club, Philadelphia, Pa., on Friday, January 12th, at 6:30 P. M. The speaker will be H. M. Wilson, consulting engineer who will discuss heat balance and power usage in paper and board mills.

# Water Retention of Beaten and Gelatinized Pulp*

By Arthur Sedoff [1] C. V. Holmberg[2] and Edwin C. Jahn[3]

**Abstract**

*The effect of beating a pulp on its ability to retain water was studied by subjecting small wet cakes of pulp to high pressures in a mold and by draining the water from pulp sheets formed on a standard sheet machine.*

*Beating a pulp definitely affects its ability to retain water under different pressures. Increased pressures up to 3000 pounds per square inch decrease the per cent of water retained, but higher pressures have little effect. The length of time that the pressure is applied greatly affects the amount of water retained. If the pressure is applied sufficiently long (4 hours or more) there is no significant difference in the amount of water retained by differently beaten pulps. The shorter the time of pressing the higher the water content and the greater the differences between pulps beaten different lengths of time. The per cent linear shrinkage correlates with per cent water retained, when the samples are pressed at 3000 pounds or over for 10 minutes, to give a straight line relationship.*

*The water content of unbeaten pulp pressed at various pressures until the outflow of water practically ceased was determined. The equilibrium moisture content at about 3000 pounds per square inch was found to correspond with the fiber saturation point of that particular pulp. Pressures below 3000 pounds cause fiber deformation and the flow of free water and higher pressures force out capillary water.*

*A good measure of beating changes for drastically beaten or gelatinized pulp is obtained by determining the water retention of a sample after pressing at 4000 pounds per square inch for 10 minutes. A good index of the degree of beating in ordinary beating practise is obtained by measuring the water content of a sheet couched from a standard sheet machine.*

A measure of the rate of water flow through a pulp mat on a screen has long been used as an indication of pulp qualities and properties. This rate of drainage, expressed as freeness or slowness, is a valuable indicator of the changes brought about by beating, particularly the degree of papermakers' "hydration" or of "gelatinization."

The qualities of a pulp mat which affect water drainage would also be expected to affect the quantity of water which the mat would retain under various conditions. This basic relationship has received comparatively little study and it seemed worthwhile to explore it further. The purpose of this study is to investigate the relation of the per cent water retained by a cellulosic mat under various conditions to the physical properties of the cellulose fibers, particularly to changes in stuff and sheet properties brought about by beating.

This relation of water retention to pulp qualities was used by Strachan *(11)* as the basis of a method for measuring the "hydration" of a pulp. A procedure due to Strachan was described in the first tentative standard method of TAPPI *(14)* for forming and testing pulp sheets, but was dropped from the revised procedure. *(15)* Strachan observed that, for pulp sheets pressed below 10 pounds per square inch, there was a decrease in water retained with increased beating but above 10 pounds pressure the reverse was the case. A pressure of 24 pounds per square inch was recommended. *(14)*

Strachan *(11, 12)* believes that beating causes an appreciable increase in water sorption and that determining the water retained by a pressed pulp sheet gives a measure of this hydration. Bell *(1)* criticized this procedure and reported that it took 14 days for equilibrium to be reached between the water content of a pulp sheet and an applied pressure of 200 pounds per square inch. Bell found that differences in per cent water retained by differently beaten pulps pressed to constant weight were small. He suggested that the volume contraction on drying of a standard pressed pulp cake might be used to indicate the degree of beating, but the method proved impractical due to cracking and irregular shrinkage of the pulp cake.

In connection with research on molding hard strong materials from gelatinized wood McCarthy and Jahn *(5)* found that, when wet cakes of comminuted sawdust or pulp were pressed at 10,000 pounds per square inch for 20 minutes, there was a relationship between the water retained by the pressed cake and the degree of beating or gelatinization. For drastically comminuted materials this seemed to be a workable test.

In a previous report *(3)* on this research project the per cent water retained by a pulp mat under standardized conditions was tentatively termed "degree of gelatinization." The term "gelatinization" is sometimes used in connection with beating *(4)* where it may be considered essentially synonymous with colloidal hydration in that it means the dispersion of water into a solid or the increase in internal water with resultant swelling. However, "gelatinization" is often used, though rather loosely, to imply not only colloidal hydration and resultant swelling but micellar disorientation and slime or gel formation.

Colloidal hydration results on simple immersion or contact of pulp with water and drastic beating causes only a very slight increase in this hydration, as measured by sorption experiments. For example, Seborg and Stamm *(9)* found that beating an unbleached spruce sulphite pulp for 8 hours had no appreciable effect on its sorption of moisture. Sheppard and Newsome *(10)* observed that the sorption of water vapor by alpha pulp is unaffected by beating. Using an improved apparatus and technique, Seborg, Simmonds and Baird *(8)* found that highly beaten pulp sorbed 0.2 to 3.5 per cent more moisture from

* Report on the TAPPI Fundamental Research Project at the School of Forestry, University of Idaho, Moscow, Idaho, which was financially aided by a TAPPI Research Grant from the Research Promotion Committee.

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[3] Member TAPPI, New York State College of Forestry, Syracuse, and formerly Professor of Forestry, University of Idaho.

the low to high humidities, respectively, than unbeaten pulp. This averages 6 per cent increase in hygroscopicity by extreme beating. Evidence from the Forest Products Laboratories of Canada is similar. Thus Campbell *(2)* reports that beating does not alter the degree of hydration to any appreciable extent, the ratio of sorption after beating to the sorption before beating being 1.04, which is almost within experimental error. More recently, Russell, Maass and Campbell *(7)* verified the earlier work, for, under more exact conditions, they found a ratio of sorption of water vapor by beaten pulp to unbeaten pulp of 1.05.

The changes in pulp properties by beating cannot, therefore, be explained by colloidal hydration or capillary imbibition, but are the result of a combination of physical changes often termed "papermakers' hydration." If gelatinization be defined as synonymous with colloidal hydration, a measure of per cent water retention does not measure gelatinization. If the changes in the physical character of the fibers, i.e., decreased effective particle size, slime formation, and micellar disorientation, be brought into the picture, these factors would cause a higher water retention due to the greater resistance to water flow.

Since the terminology of the changes which take place during beating is unclarified and confusing and since the per cent water retained by a pulp mat is undoubtedly due to a combination of properties, the values obtained in this work are expressed simply as "per cent water retained."

The retention of water by wet pulp was determined under a wide range of conditions by two general methods, the first by pressing small cakes of pulp in a mold at high pressures and the second by measuring the water retention of pulp sheets formed on an official sheet machine *(15)* approved by the Paper Makers' Association of Great Britain and Ireland. Tests were made on pulps drastically beaten in a steel rod mill and on pulp less drastically beaten in a laboratory pulp beater.

## Experimental Procedure

Commercial bleached western hemlock sulphate pulp was used throughout this work for all beating runs and for all water retention and other pulp tests. The determination of equilibrium moisture content at various pressures was done on an unbeaten unbleached sulphite pulp.[4]

### Beating in the Rod Mill

Pulp was beaten in a rod mill for 8 different periods of time, namely, ½, 1, 4, 8, 16, 24, 32 and 48½ hours. For each run a charge of 375 grams of air-dry pulp was used. The dry pulp was first disintegrated in tap water at 6 per cent consistency for 15 minutes by a TAPPI standard disintegrator. *(13)* The pulp was filtered on a Buchner funnel, washed with distilled water, made up to 6 per cent consistency in distilled water and beaten. At the end of the predetermined time the pulp was filtered on a Buchner funnel, washed with distilled water, placed in two-quart jars with 2 cc. of toluene to prevent bacterial and mold growth and sealed.

The rod mill used was made of stainless steel, 12 x 24 inches (inside measurements). Twenty-five stainless steel rods ⅞ x 23 inches and weighing 1794 grams each were used.

[4] Furnished by A. J. Stamm and C. Seborg, Forest Products Laboratory, Madison, Wis.

### Beating in a Laboratory Beater

Pulp was beaten in a 1½ pound laboratory beater according to the official corrected TAPPI standard procedure. *(13)* Five charges of 400 grams air dry pulp each were used. Disintegration and beating were done in tap water. During the first 2 runs 800 cc. samples were removed after 0, 5, 15, 30, 45, and 60 minutes beating. In the 3rd run 3-liter samples were removed after 0, 5 and 15 minutes beating; in the 4th run after 30, 45, and 60 minutes; and in the 5th run after 75, 90, and 105 minutes. The samples were sealed with 2 cubic centimeters of toluene in two-quart jars.

### Measuring Water Retention at High Pressure

To measure the water retained by a pulp cake pressed in a mold it is first necessary to standardize the size and moisture content of the sample. Therefore, all samples were weighed to equal approximately 2 grams, oven-dry equivalent, after the moisture content had been brought to approximately 60 per cent, wet basis. This was done by drawing off excess water from the pulp on a Buchner funnel and then pressing 50 grams of this pulp (approximately 80 per cent water) in a 10 square inch cylindrical mold having a base drilled with 1/16 inch holes and grooved on the lower side to permit escape of water. A moisture content very close to 60 per cent was obtained by pressing at 100 pounds per square inch in a screw-type hand press for 5 minutes. In some cases somewhat higher pressures and longer times were used to bring the pulp to less than 60 per cent water. The mat was then weighed, broken up, its moisture determined and sufficient water added to bring the sample to 60 per cent water.

Two gram samples (oven-dry equivalent) of this wet pulp were pressed between moist felts in a one square inch cylindrical plunger type mold. The felts were used to prevent water flowing back onto the pulp mat when the pressure was released. The mold consisted of 3 parts, the cylinder or body, the base and the plunger. The cylinder was 3 inches high, 2¼ inches in external diameter and 1.153 inches inside diameter. The base was ¾ inches high with a ¼ inch flange, the part projecting into the cylinder being 1.1465 inches in diameter. The plunger was 3¼ inches high with a flange at the top and was 1.1465 inches in diameter. The pulp was compressed in this mold in a hydraulic press with a 5 inch diameter ram capable of exerting a maximum force of 30 tons. The press was equipped with 2 gauges, one reading 0-20,000 pounds and the other 0-30 tons.

The per cent water retained was measured, as also were the per cent "elastic contraction" of the moist cake when it was removed from the mold and the per cent linear shrinkage of the pulp cake after drying. The water retained was measured by weighing the sample in a glass-stoppered weighing bottle immediately after pressing, then drying at 103-105 deg. C. for 12-16 hours and weighing. Each value in the tables and figures is the average of 2 or more samples.

The diameter of each sample, both wet and dry, was measured by a micrometer. Ten readings were made on each sample and the values averaged.

### Measuring Water Retention of Sheets Formed on a Sheet Machine

The per cent water retained was determined on pulp sheets formed on the British standard sheet machine according to the TAPPI revised tentative

standard condition *(15)* with the following exceptions: (a) disintegration was dispensed with for the pulps beaten in the standard beater—these pulps at 1.75 per cent consistency were diluted to 0.15 per cent consistency for forming the sheets; (b) three blotters instead of two were used in couching in all cases, and (c) the time at which the air-inlet needle valve was opened was varied at 0, 10, and 30 seconds after the water passed through the sheet.

Per cent water retention was determined on sheets immediately after couching and also on sheets after the initial pressing at 60 pounds (50 lb. gauge pressure) per square inch for 5 minutes. The water retained was measured by weighing the wet sheet in a wide, glass-stoppered weighing bottle and again after drying 12-16 hours at 103-105 deg. C.

### Measuring Slowness and Strength Factors

Slowness tests were determined by measuring the rate of drainage in a vertical glass cylinder slowness tester of the type described by Richter. *(6)*

Tensile strength, stretch under tension, tearing strength and bursting strength were determined on pulp sheets according to revised tentative TAPPI methods *(15)* on all the pulps studied. Tensile strength and stretch were measured on a Schopper-Riegler hand driven instrument. Tearing strength was determined on an Elmendorf tear tester and bursting strength was measured on a Mullen motor-driven instrument.

The wet pulp sheets were dried and conditioned in a specially constructed humidity chamber. This chamber was constructed of fiber insulating board and had a double wall with an air space between. The interior consisted of 2 chambers, the upper of a size sufficient to accommodate 3 stacks of drying rings. Air was blown by a blower through a grating and horizontally through the drying rings. It then passed below the floor of the first chamber and came in contact with a large surface of a saturated solution of sodium nitrite, containing an excess of the salt, by blowing over paddles which dipped into a bath of this solution. The air was then again blown over the wet sheets. The chamber was kept in a room at approximately 70 deg. F at which temperature a constant humidity very close to 65 per cent was maintained in the chamber.

Prior to and during the tests the instrument room

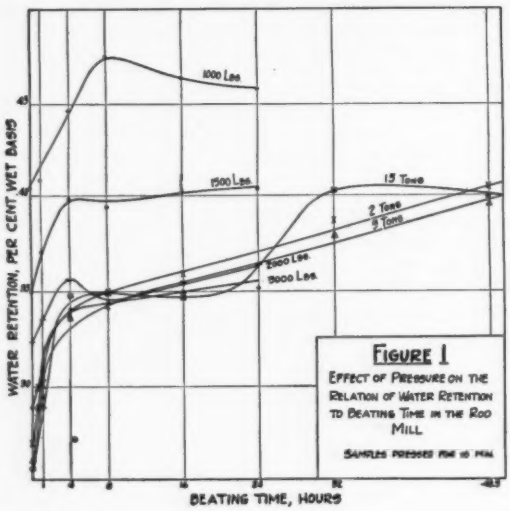



**Figure 1**
Effect of Pressure on the Relation of Water Retention to Beating Time in the Rod Mill
Samples pressed for 10 min.

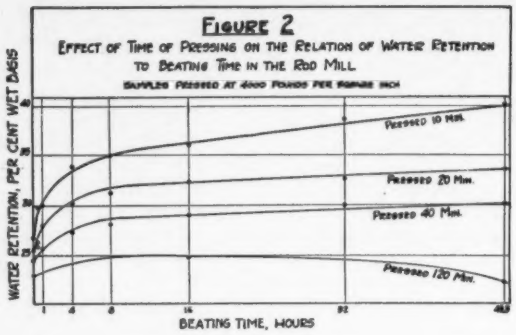



**Figure 2**
Effect of Time of Pressing on the Relation of Water Retention to Beating Time in the Rod Mill
Samples pressed at 4000 pounds per square inch

was brought to and maintained at approximately 65 per cent relative humidity and 70 deg. F as determined by a wet and dry bulb hygrometer.

### Determination of Water Content in Equilibrium With Different Pressures

The water content in equilibrium with various pressures was determined on unbeaten, unbleached sulphite pulp whose moisture sorption values had been determined by C. Seborg of the Forest Products Laboratory, Madison, Wis. The pulp was brought to a water content of 60 per cent (wet basis) and for each test a two-gram (oven dry equivalent) sample was used. The samples were pressed in a one square inch cylindrical mold which was surrounded with a wet towel to prevent what slight evaporation might occur from the mold.

Each sample was pressed continuously at a determined constant pressure and weighed in a glass-stoppered weighing bottle every 4 hours. The pressing was continued until the loss in weight per hour was 0.003 grams or less. The outflow of water was extremely small at this point and the resistance to further flow was considered to be in approximate equilibrium with the pressure applied. The time required to reach this equilibrium varied from 16 to 60 hours. The values obtained must be considered as approximate, due not only to the fact that small traces of water were still being removed from the samples, but also because of the difficulty in maintaining absolutely constant pressure over long periods of time with the press used.

The thickness of each sample was measured before it was removed from the mold by measuring with a micrometer the depth to which the plunger had moved. From these figures the total weight per unit volume and the weight of dry solids per unit volume were calculated.

## Results and Discussion

The two most important factors affecting the per cent water retained by a given mat of wet pulp are the pressure to which the pulp is subjected and the length of time that the pressure is applied. When a wet cake of pulp is subjected to pressure it can be assumed that the pressure is resisted by two forces: (1) the resistance of the fibers to deformation and (2) the resistance to flow of the water through the capillaries. Hence the force under which the mat is pressed will affect the degree of compression of the fibers and the amount of water that is forced from the mat. The length of time that the force is applied will affect the amount of water retained, since the rate of outflow of the capillary water is slow and a long time is required before water flow has stopped under a given pressure. Beating a pulp increases its

retention of water at given conditions of pressure and time. The results observed in this study confirm these statements.

### Factors Affecting Water Retention Under Pressure

In previous work *(5)* it was found that with increasing size of sample (dry basis) the water retention increased somewhat. The original moisture content of the samples also affect the final water retained (Table I). Therefore, the size (dry basis) and moisture content of the samples must be standardized.

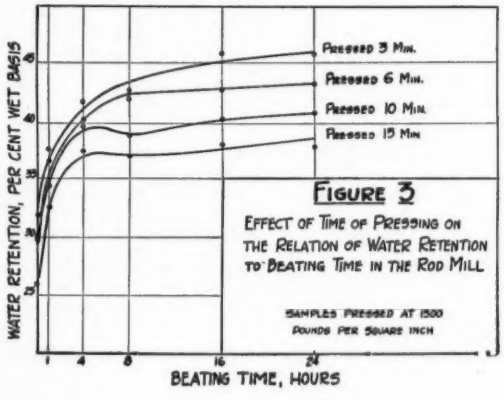
*Pressure.* The amount of water retained by a cake of wet pulp subjected to pressure in a mold for a given length of time is greatly affected by the amount of pressure applied for values below approximately 3000 pounds per square inch. Differences in pressure above 3000 pounds have comparatively little effect. The results for pressure applied for 10 minutes are shown in Fig. 1. The best differentiation in per cent

TABLE I
EFFECT OF ORIGINAL MOISTURE CONTENT ON WATER RETENTION OF PULP PRESSED FOR 10 MINUTES AT 4000 POUNDS PER SQUARE INCH

| Hours Beaten in Rod Mill | Original Per Cent Water | Per Cent Water Retained |
|---|---|---|
| 0 | 52.7 | 26.4 |
| 0 | 69.5 | 29.9 |
| 0.5 | 55.9 | 28.1 |
| 0.5 | 74.7 | 30.1 |
| 1 | 61.0 | 29.8 |
| 1 | 74.8 | 34.1 |
| 4 | 58.6 | 32.9 |
| 4 | 77.1 | 38.3 |
| 8 | 62.0 | 32.5 |
| 8 | 78.9 | 34.4 |
| 16 | 60.0 | 35.2 |
| 16 | 77.7 | 36.5 |

water retained for different times of beating is shown at 4000 pounds pressure. The variations in the curve representing 30,000 pounds is probably due to losses of fine solids and to a plugging of the felts by the highly beaten samples, thus retarding water flow at this high pressure.

*Time.* Increasing the time that a wet pulp cake is subjected to pressure decreases its water content, until, after a period of hours, a constant value is approached. The optimum time for the application of a given pressure would be that which showed the greatest differences in water content between differently beaten samples, other factors being satisfactory. At a pressure of 4000 pounds the best time of the different periods studied is 10 minutes (Fig. 2). At 1500 pounds pressure 6 minutes gives better results than 3, 10 or 15 minutes. Although in Fig. 3 the curve at 3 minutes shows the greatest differentiation in per cent water retained with different beating


WATER RETENTION, PER CENT WET BASIS
BEATING TIME, HOURS
PRESSED 3 MIN.
PRESSED 6 MIN.
PRESSED 10 MIN.
PRESSED 15 MIN.
FIGURE 3
EFFECT OF TIME OF PRESSING ON THE RELATION OF WATER RETENTION TO BEATING TIME IN THE ROD MILL
SAMPLES PRESSED AT 1500 POUNDS PER SQUARE INCH

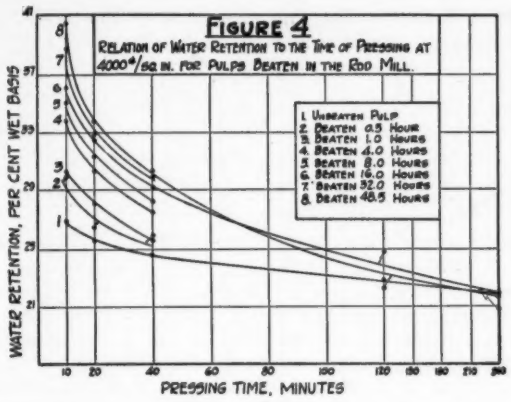


FIGURE 4
RELATION OF WATER RETENTION TO THE TIME OF PRESSING AT 4000 LB/SQ IN. FOR PULPS BEATEN IN THE ROD MILL
1. UNBEATEN PULP
2. BEATEN 0.5 HOUR
3. BEATEN 1.0 HOURS
4. BEATEN 4.0 HOURS
5. BEATEN 8.0 HOURS
6. BEATEN 16.0 HOURS
7. BEATEN 32.0 HOURS
8. BEATEN 48.5 HOURS
WATER RETENTION, PER CENT WET BASIS
PRESSING TIME, MINUTES

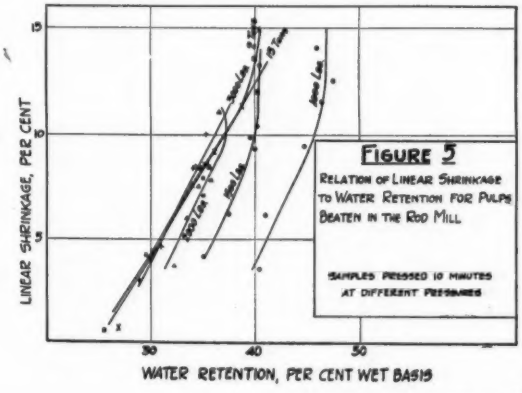
times, the deviation of individual tests from the average is much greater for this short time than at 6 minutes.

The effect of time is best seen in Fig. 4 which shows the relation of per cent water retained to time of pressing. Each curve is for a differently beaten pulp and all values were obtained by pressing at a constant pressure of 4000 pounds per square inch. The greatest spread in values between the different pulps is at the shortest time of pressing, and, with increased time of pressing, the differentiation disappears. The values for per cent water retained all tend to approach the same figure regardless of the extent of beating. This is as expected since the literature shows that there is no significant difference in the hydration of pulps due to beating.

### Correlation of Water Retention Under High Pressure With Linear Shrinkage

Due to irregularities in shape of the dry shrunken cakes of pulp the per cent error in measuring linear shrinkage is undoubtedly high. However, an approximation of the true figure was obtained by averaging ten readings for each cake. These values indicate that the relation of per cent linear shrinkage to per cent water retained is practically a straight line relationship for samples pressed at 3000 pounds or higher for 10 minutes (Fig. 5). The water content of samples pressed under these conditions correlates with a density factor of the dry pulp cake.

It was found upon releasing the pressure on the wet pulp cake that the cake nearly always had a diameter smaller than the diameter of the mold (Table II). At 3000 pounds and above this contraction is positive in all cases for unbeaten and beaten pulps. At 2000 pounds and less the contraction is negative


LINEAR SHRINKAGE, PER CENT
WATER RETENTION, PER CENT WET BASIS
FIGURE 5
RELATION OF LINEAR SHRINKAGE TO WATER RETENTION FOR PULPS BEATEN IN THE ROD MILL
SAMPLES PRESSED 10 MINUTES AT DIFFERENT PRESSURES

for unbeaten pulp. The expansion of the cake upon release of pressure and removing from the mold is overcome for unbeaten pulp at approximately 3000 pounds, for pulp beaten 1 hour at approximately 1500 pounds and for pulp beaten 4 hours at approximately 500 pounds.

With increased beating there is an increase in per cent shrinkage regardless of the pressure to which the pulp is subjected.

### Equilibrium Between Pressure and Water Content

If a given pressure is applied to a wet pulp cake long enough, the outflow of water will cease and an equilibrium will be reached between the pressure applied and the moisture content of the pulp. With increased pressure this equilibrium moisture content becomes less (Fig. 6). This decrease in moisture content with increased pressure rapidly falls off at pressures above 3000 pounds; the resistance to outflow becoming greater as the moisture content becomes less.

If the grams of wet pulp per unit volume at equilibrium and the grams of dry solid per unit volume at equilibrium be plotted against the pressure, a rapid rise in weight per unit volume takes place with increased pressure up to about 3000 pounds. At this pressure a sharp break occurs and the increase in weight with increased pressure is small. It is interesting to note that the break in these curves, as well as a marked change in the slope of the equilibrium water content—pressure curve occurs at about 3000 pounds pressure per square inch. It is significant that the equilibrium moisture content (35.04 per cent, dry basis) at 3000 pounds is nearly identical to the fiber saturation point (35.5 per cent, dry basis) of this particular pulp as determined by extrapolation of the original moisture desorption curve for this pulp from the data furnished by C. Seborg of the Forest Products Laboratory, Madison, Wis.

Therefore, a pressure of 3000 pounds per square inch applied to unbeaten sulphite pulp until the moisture content is approximately constant has forced out all the free water. At this pressure the fibers must be crushed so that no fiber cavities exist and the fibers are in intimate contact. This is borne out by the curves representing the relation of weight of wet pulp and of dry solids per unit volume to pressure. At pressures somewhat above 3000 pounds the rapid rate of compacting of the pulp with increased pressure suddenly ceases. The first part of these curves, up to about 3000 pounds pressure, represents the forcing out of free water plus the crushing of the fibers, whereas, the second part of the curves, above 3000 pounds, represents the forcing out of capillary water and the compacting of the cellulose mass by decreasing the average effective capillary diameters. As the capillaries become smaller, greater pressures are necessary to force out the same increment of water.

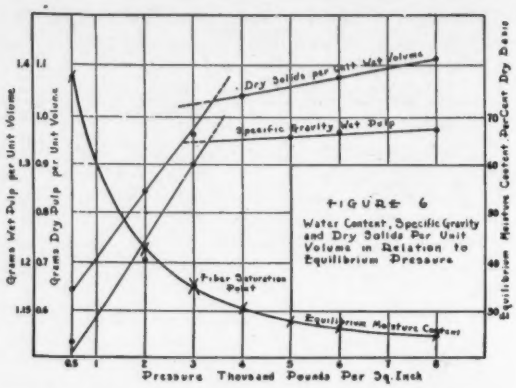

Grams Wet Pulp per Unit Volume
Grams Dry Pulp per Unit Volume
Equilibrium Moisture Content-Per Cent Dry Basis
Dry Solids per Unit Wet Volume
Specific Gravity Wet Pulp
Fiber Saturation Point
Equilibrium Moisture Content
Pressure Thousand Pounds Per Sq. Inch

FIGURE 6
Water Content, Specific Gravity and Dry Solids Per Unit Volume in Relation to Equilibrium Pressure

This change at about 3000 pounds pressure in the character of the pulp mat and the forces resisting the applied pressure is also indicated by the following facts. (1) Variation of pressure above 3000 pounds has very little effect on the water retained (Fig. 1). (2) At about 3000 pounds there is a change in the relation of water retention to per cent linear shrinkage of the pressed pulp cake (Fig. 5). (3) A change

TABLE II

LINEAR SHRINKAGE, ELASTIC CONTRACTION AND WATER RETENTION OF PULP BEATEN IN THE ROD MILL AND PRESSED AT DIFFERENT CONDITIONS

| Hours Beaten | | 30000 lb. for 40 min. | 4000 lb. for 10 min. | 3000 lb. for 10 min. | 2000 lb. for 10 min. | 1500 lb. for 10 min. | 1500 lb. for 6 min. | 500 lb. for 10 min. |
|---|---|---|---|---|---|---|---|---|
| 0 | Linear Shrinkage, per cent* | 2.66 | 0.70 | 3.07 | 3.74 | 4.21 | 3.07 | .. |
| | Elastic Contraction, per cent** | 0.12 | 2.22 | 0.17 | −0.34 | −0.68 | −0.34 | −1.36 |
| | Water Retention, per cent | 22.00 | 26.90 | 28.80 | 32.20 | 35.00 | 34.90 | 43.30 |
| | Ave. Deviation of Water Ret. | 0.33 | 0.33 | 0.43 | 0.73 | 0.30 | 0.87 | 0.91 |
| 0.5 | Linear Shrinkage, per cent* | 3.64 | 4.06 | .. | .. | .. | .. | .. |
| | Elastic Contraction, per cent** | 0.30 | 0.39 | .. | .. | .. | .. | .. |
| | Water Retention, per cent | 24.40 | 29.90 | .. | .. | .. | .. | .. |
| | Ave. Deviation of Water Ret. | 0.56 | 0.35 | .. | .. | .. | .. | .. |
| 1.0 | Linear Shrinkage, per cent* | .. | 4.47 | 4.64 | 5.97 | 6.14 | 5.80 | .. |
| | Elastic Contraction, per cent** | .. | 0.32 | 0.68 | 0.00 | 0.00 | 0.00 | −0.85 |
| | Water Retention, per cent | 24.60 | 30.10 | 30.90 | 33.40 | 37.20 | 38.50 | 44.60 |
| | Ave. Deviation of Water Ret. | 0.30 | 0.20 | 0.23 | 0.68 | 0.52 | 0.47 | 0.37 |
| 4 | Linear Shrinkage, per cent* | .. | 7.28 | 8.28 | 7.73 | 9.28 | 8.96 | .. |
| | Elastic Contraction, per cent** | .. | 1.01 | 1.02 | 1.02 | 0.68 | 1.02 | 0.17 |
| | Water Retention, per cent | 27.60 | 33.80 | 34.00 | 35.70 | 39.80 | 40.10 | 46.40 |
| | Ave. Deviation of Water Ret. | 0.57 | 0.80 | 0.30 | 0.67 | 0.47 | 0.50 | 0.93 |
| 8 | Linear Shrinkage, per cent* | .. | 8.37 | 8.30 | 7.40 | 9.82 | 11.38 | .. |
| | Elastic Contraction, per cent** | .. | 1.22 | 1.36 | 0.85 | 0.85 | 1.02 | 0.00 |
| | Water Retention, per cent | 27.20 | 35.00 | 34.30 | 34.50 | 39.40 | 41.00 | 44.50 |
| | Ave. Deviation of Water Ret. | 0.77 | 0.60 | 0.03 | 1.10 | 1.40 | 0.63 | 1.40 |
| 16 | Linear Shrinkage, per cent* | 5.77 | 9.03 | 8.28 | 8.44 | 10.47 | 12.40 | .. |
| | Elastic Contraction, per cent** | 0.61 | 1.32 | 1.02 | 1.02 | 0.51 | 0.68 | −0.34 |
| | Water Retention, per cent | 26.80 | 36.00 | 35.40 | 35.50 | 40.20 | 41.30 | 46.40 |
| | Ave. Deviation of Water Ret. | 0.47 | 0.40 | 0.97 | 1.48 | 0.50 | 0.37 | 0.48 |
| 24 | Linear Shrinkage, per cent* | .. | .. | 10.00 | 11.05 | 13.25 | 12.10 | .. |
| | Elastic Contraction, per cent** | .. | .. | 1.70 | 1.36 | 1.02 | 1.37 | 0.00 |
| | Water Retention, per cent | .. | .. | 35.20 | 36.50 | 40.40 | 41.60 | 48.40 |
| | Ave. Deviation of Water Ret. | .. | .. | 0.70 | 0.70 | 1.33 | 1.50 | 0.50 |
| 32 | Linear Shrinkage, per cent* | .. | 11.30 | | | | | |
| | Elastic Contraction, per cent** | .. | 1.71 | | | | | |
| | Water Retention, per cent | 29.50 | 38.70 | | | | | |
| | Ave. Deviation of Water Ret. | 0.23 | 0.40 | | | | | |
| 48.5 | Linear Shrinkage, per cent* | 9.11 | 14.87 | | | | | |
| | Elastic Contraction, per cent** | 0.86 | 1.94 | | | | | |
| | Water Retention, per cent | 27.90 | 40.40 | | | | | |
| | Ave. Deviation of Water Ret. | 0.87 | 0.30 | | | | | |

* Per cent linear shrinkage from size when removed from mold to dry size.

** Per cent linear elastic contraction from size in mold under pressure to size immediately after removal from mold.

from expansion to contraction takes place at about 3000 pounds when a pressed unbeaten cake is removed from the mold (Table II).

### Water Retention at High Pressure as a Measure of Changes Brought About by Beating.

Beating a pulp affects its effective fiber or particle size and also the stiffness of its fibers and their ability to resist crushing. Hence if a wet pulp cake is pressed under definite conditions, the amount of water retained should vary with the degree of beating, which is true. Of the various conditions examined at high pressures, the best measure of beating changes in a pulp are shown by the values obtained by pressing samples at 4000 pounds per square inch for 10 minutes (Fig. 1). The differences in water retained are not very large except for appreciable differences in beating time, but if the per cent water is expressed on the basis of dry pulp the differentiation is greater (Fig. 7). A measure of the per cent water retention under high pressure is a satisfactory indication of beating changes for drastically beaten pulps. For pulp rod-milled over 4 hours it is a better measure than sheet strength tests (Fig. 7) or slowness, the time factor in the latter test being too great.

For shorter beating time, 1500 pounds pressure for 6 minutes gives results somewhat better than those at 4000 pounds for 10 minutes (Table II, Figs. 3 and 7). Therefore, these milder pressing conditions were used in the beater runs (maximum beating time, 105 minutes) (Tables III and IV).

### Water Retention of Standard Pulp Sheets as a Measure of Beating.

Measuring water retention at high pressures is not a satisfactory test for changes in pulp brought about by ordinary beating practice, nor is the test rapid or convenient. However, determination of the water retention of pulp sheets formed on the standard sheet machine gives rapidly obtainable and much more satisfactory results for shorter periods of beating. For example, beating 15 minutes in a laboratory beater showed an average increase in per cent water (dry basis) in a couched sheet of 57 per cent (from 223 to 280) and beating one hour an increase of 183 per cent (from 223 to 406) over the unbeaten pulp. Measuring water retention at 1500 pounds pressure for 6 minutes showed no increase after 15 minutes beating and a difference of only 10.9 per cent (dry basis) after beating 1 hour.

Best results were obtained by weighing the wet

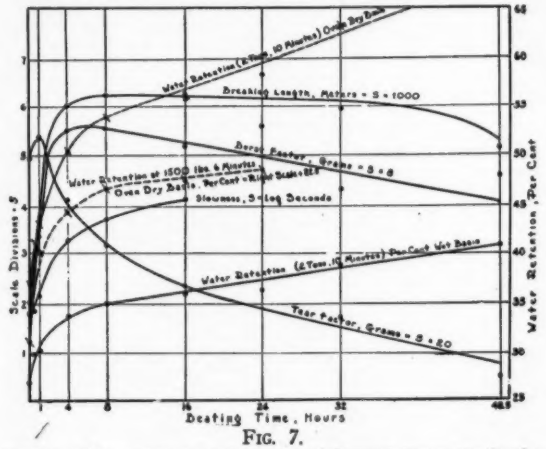

Breaking Length, Meters = S × 1000
Burst Factor, Grams = S × 8
Slowness, S = Log Seconds
Tear Factor, Grams = S × 80
Scale Divisions - S
Water Retention, Per Cent
Beating Time, Hours

FIG. 7.

**Relation of Water Retention Slowness and Strength Factors to Beating Time in a Rod Mill.**

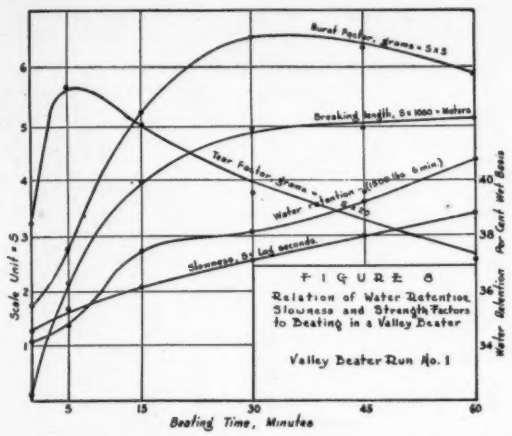

Burst Factor, Grams = S × 8
Breaking Length, S × 1000 = Meters
Tear Factor, Grams = S (Constant Pressure 6 min.)
Water Retention (Pressure 6 min.)
Slowness, S = Log Seconds
Scale Unit = S
Water Retention, Per Cent Wet Basis
Beating Time, Minutes

FIGURE 8

Relation of Water Retention Slowness and Strength Factors to Beating in a Valley Beater

Valley Beater Run No. 1

sheet immediately after couching instead of pressing at 60 pounds according to standard sheet making conditions; the former method giving much more accurate and reproducible data (Table III). Best results were also obtained by opening the air needle valve to release the water head below the sheet immediately that the water level had passed through the sheet (Fig. 10).

The per cent water retained in unpressed couched sheets gives a good measure of beating comparing favorably with some of the standard tests (Figs. 8 and 9, Tables III and IV). It has the advantage of being a rapid test, for two extra sheets can be readily made when standard sheets are being formed and only the wet and dry weight of these is needed for accurate results. Since the consistency is known in preparing standard sheets an approximate figure is obtained directly from the wet weight.

## Summary and Conclusions

The effect of beating a pulp on its ability to retain water was studied by subjecting small wet cakes of pulp to high pressures in a mold and by draining the water from pulp sheets formed on a standard sheet machine.

Factors affecting the measure of water retention under pressure were studied, particularly the pressure and the time of application of pressure. The determination of water retention under high pressure was applied to pulps drastically beaten in a rod mill.

Changes in pulp properties brought about by beating for shorter periods of time in a Valley beater

TABLE III

WATER RETENTION OF PULP SHEETS AND OF PRESSED PULP, LINEAR SHRINKAGE, SLOWNESS AND BURST FACTOR FOR PULP BEATEN IN THE STANDARD BEATER

Beater Run No. 2

| Beating Time, Minutes | Water Retention of Pulp Sheets, Per Cent: After Couching | Water Retention of Pulp Sheets, Per Cent: After Pressing at 60 lb. per sq. in. | Water Retention in Pulp Pressed at 1500 lb. per sq. in. for 6 min. Per Cent. | Linear Shrinkage, Average of Beater Runs 2 and 3 Per Cent | Slowness, Seconds | Burst factor, Ave. |
|---|---|---|---|---|---|---|
| | 68.85 | 54.7 | 35.9 | | | |
| 0 | 68.21 | 49.0 | 35.6 | 3.23 | 61 | 7.21 |
| | 70.9 | 57.2 | 34.5 | | | |
| 5 | 70.8 | 57.0 | 35.0 | 3.41 | 69 | 14.4 |
| | 73.3 | 60.3 | 35.4 | | | |
| 15 | 73.5 | 60.4 | 35.0 | 3.51 | 114 | 25.3 |
| | 75.6 | 62.8 | 37.6 | | | |
| 30 | 75.8 | 65.1 | 37 7 | 3.78 | 398 | 33.6 |
| | 76.8 | 64.8 | 38.5 | | | |
| 45 | 77.4 | 64.7 | 39.3 | 4.55 | 1240 | 32.6 |
| | 79.8 | 65.7 | 39.8 | | | |
| 60 | 79.3 | 66.7 | 39.0 | 6.05 | 2100+ | 30.4 |

TABLE IV
WATER RETENTION OF PULP BEATEN IN THE STANDARD BEATER

| Beating Time, Minutes | Beater Run No. 3 Water Retention of Pulp Sheets After Couching, Per Cent: Individual Values | Average | Average Deviation | Water Retention in Pulp Pressed at 1500 lb. for 6 min., Per Cent |
|---|---|---|---|---|
| 0 | 69.3 | ... | ... | ... |
| | 69.7 | ... | ... | ... |
| | 69.2 | ... | ... | 36.5 |
| | 69.5 | 69.4 | 0.18 | 36.7 |
| 5 | 69.5 | ... | ... | ... |
| | 69.2 | ... | ... | ... |
| | 69.4 | ... | ... | 36.1 |
| | 69.3 | 69.4 | 0.10 | 36.1 |
| 15 | 73.8 | ... | ... | ... |
| | 74.0 | ... | ... | ... |
| | 74.1 | ... | ... | 36.3 |
| | 73.8 | 73.9 | 0.13 | 36.2 |
| 30 | 76.3 | ... | ... | ... |
| | 77.6 | ... | ... | ... |
| | 77.2 | ... | ... | 37.7 |
| | 77.0 | 77.0 | 0.38 | 38.2 |
| 45 | 78.8 | ... | ... | ... |
| | 79.8 | ... | ... | ... |
| | 79.4 | ... | ... | 39.6 |
| | 78.9 | 79.2 | 0.38 | 39.3 |
| 60 | 80.2 | ... | ... | ... |
| | 81.2 | ... | ... | ... |
| | 81.0 | ... | ... | 40.6 |
| | 80.8 | 80.8 | 0.30 | 40.6 |
| 75 | 80.7 | ... | ... | ... |
| | 82.0 | ... | ... | ... |
| | 81.7 | ... | ... | 41.7 |
| | 82.1 | 81.6 | 0.48 | 40.3 |
| 90 | 83.6 | ... | ... | ... |
| | 82.3 | ... | ... | ... |
| | 82.7 | ... | ... | 41.8 |
| | 83.2 | 83.0 | 0.45 | 42.4 |
| 105 | 83.7 | ... | ... | ... |
| | 83.4 | ... | ... | ... |
| | 84.1 | ... | ... | ... |
| | 83.1 | 83.6 | 0.33 | ... |

were studied by measuring the per cent water retained by pulp sheets formed on a standard sheet machine. The effect of beating on water retention was compared with other measures of beating, namely bursting, tearing and tensile strength and slowness.

The relation of water content to the pressure applied when water outflow had ceased was observed.

The following conclusions may be drawn from the data:

(1) The per cent water retained by wet pulp increases with increased beating.

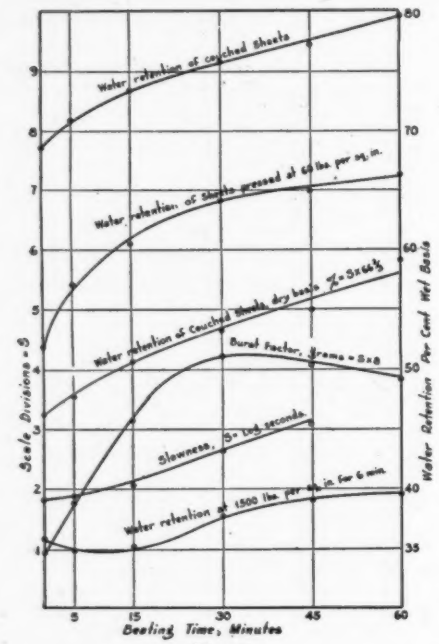

Water retention of couched sheets
Water retention of sheets pressed at 60 lbs. per sq. in.
Water retention of couched sheets, dry basis
Burst Factor, Grams = S×B
Slowness, S= Lbs. seconds
Water retention at 1500 lbs. per sq. in. for 6 min.
Scale Divisions = S
Water Retention Per Cent Wet Basis
Beating Time, Minutes

FIG. 9.

**Relation of Water Retention Measured at 1500 Pounds and in Standard Sheets to Beating Time. Standard Beater Run No. 2.**

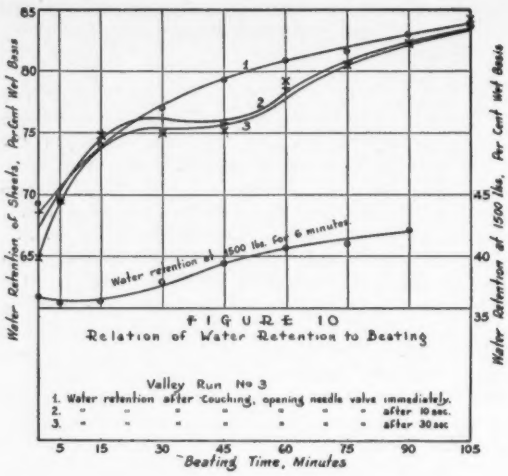

Water Retention of Sheets, Per Cent Wet Basis
Water Retention at 1500 lbs. Per Cent Wet Basis
Water retention at 1500 lbs. for 6 minutes
1. Water retention after couching, opening needle valve immediately.
2. " " " " " " after 10 sec.
3. " " " " " " after 30 sec.
Beating Time, Minutes

FIGURE 10
Relation of Water Retention to Beating
Valley Run No 3

(2) Increased pressures up to 3000 pounds per square inch decrease the per cent water retained for any constant time of pressing. Above 3000 pounds, variation in pressure has little effect on the per cent water retained.

(3) Increased time of pressing at any constant pressure decreases the water content. In general, the shorter the time pressed the greater the differentiation in water content due to beating.

(4) Beating has no effect on the water retained if the pulp is subjected to pressure sufficiently long (4+ hours).

(5) The per cent linear shrinkage of pressed pulp

TABLE V.
SUMMARY OF AVERAGE VALUES OF WATER RETENTION OF PULP BEATEN IN THE ROD MILL AND PRESSED AT DIFFERENT CONDITIONS

| Hours Beaten | Minutes Pressed | Per Cent Water Retention at Various Pressures: 500 lbs. | 1,500 lbs. | 2,000 lbs. | 3,000 lbs. | 4,000 lbs. | 10,000 lbs. | 30,000 lbs. |
|---|---|---|---|---|---|---|---|---|
| 0 | 3 | ... | 35.1 | ... | ... | ... | ... | ... |
| | 6 | ... | 34.9 | ... | ... | ... | ... | ... |
| | 10 | 43.3 | 35.0 | 32.2 | 28.8 | 26.9 | 26.0 | 25.6 |
| | 15 | ... | 33.9 | ... | ... | ... | ... | ... |
| | 20 | ... | ... | ... | ... | 25.6 | 23.2 | 22.1 |
| | 40 | ... | ... | ... | ... | 24.6 | 21.3 | 22.0 |
| | 120 | ... | ... | ... | ... | 22.9 | 17.7 | 19.6 |
| | 240 | ... | ... | ... | ... | 21.9 | 17.3 | 17.2 |
| 0.5 | 10 | ... | ... | ... | ... | 29.9 | 28.9 | 28.8 |
| | 20 | ... | ... | ... | ... | 26.4 | 25.3 | 26.6 |
| | 40 | ... | ... | ... | ... | 25.9 | 23.7 | 24.4 |
| 1 | 3 | ... | 37.9 | ... | ... | ... | ... | ... |
| | 6 | ... | 38.5 | ... | ... | ... | ... | ... |
| | 10 | 44.6 | 37.2 | 33.4 | 30.9 | 30.1 | 29.0 | 29.5 |
| | 15 | ... | 37.2 | ... | ... | ... | ... | ... |
| | 20 | ... | ... | ... | ... | 28.1 | 26.2 | 27.6 |
| | 40 | ... | ... | ... | ... | 25.7 | 24.5 | 24.6 |
| 4 | 3 | ... | 39.0 | ... | ... | ... | ... | ... |
| | 6 | ... | 40.1 | ... | ... | ... | ... | ... |
| | 10 | 46.4 | 39.8 | 35.7 | 34.0 | 33.8 | 33.5 | 34.8 |
| | 15 | ... | 39.0 | ... | ... | ... | ... | ... |
| | 20 | ... | ... | ... | ... | 30.3 | 30.0 | 28.7 |
| | 40 | ... | ... | ... | ... | 27.4 | 26.9 | 27.6 |
| 8 | 3 | ... | 40.5 | ... | ... | ... | ... | ... |
| | 6 | ... | 41.0 | ... | ... | ... | ... | ... |
| | 10 | 44.5 | 39.4 | 34.5 | 34.3 | 35.0 | 34.4 | 34.9 |
| | 15 | ... | 37.7 | ... | ... | ... | ... | ... |
| | 20 | ... | ... | ... | ... | 31.3 | 30.2 | 32.1 |
| | 40 | ... | ... | ... | ... | 28.2 | 27.7 | 27.2 |
| 16 | 3 | ... | 43.6 | ... | ... | ... | ... | ... |
| | 6 | ... | 41.3 | ... | ... | ... | ... | ... |
| | 10 | 46.4 | 40.2 | 35.4 | 35.4 | 36.0 | 35.0 | 34.6 |
| | 15 | ... | 39.4 | ... | ... | ... | ... | ... |
| | 20 | ... | ... | ... | ... | 32.4 | 32.0 | 32.5 |
| | 40 | ... | ... | ... | ... | 29.1 | 28.2 | 26.8 |
| | 120 | ... | ... | ... | ... | 24.8 | 20.8 | 22.4 |
| | 240 | ... | ... | ... | ... | 20.9 | 17.9 | 20.5 |
| 24 | 3 | ... | 42.5 | ... | ... | ... | ... | ... |
| | 6 | ... | 41.6 | ... | ... | ... | ... | ... |
| | 10 | 48.4 | 40.4 | 36.5 | 35.2 | ... | ... | ... |
| | 15 | ... | 38.9 | ... | ... | ... | ... | ... |
| 32 | 10 | ... | ... | ... | ... | 38.7 | 38.1 | 40.3 |
| | 20 | ... | ... | ... | ... | 32.7 | 33.3 | 32.3 |
| | 40 | ... | ... | ... | ... | 30.0 | 30.9 | 29.5 |
| 48.5 | 10 | ... | ... | ... | ... | 40.4 | 39.6 | 39.9 |
| | 20 | ... | ... | ... | ... | 33.7 | 34.2 | 35.5 |
| | 40 | ... | ... | ... | ... | 30.2 | 27.8 | 27.9 |
| | 120 | ... | ... | ... | ... | 22.3 | 21.6 | 20.9 |
| | 240 | ... | ... | ... | ... | 21.7 | 18.3 | 18.5 |

cakes increases with beating. The per cent linear shrinkage correlates with per cent water retention to give approximately straight line relationships for pressures above 3000 pounds.

(6) The stiffness of the fibers or their resistance to crushing and deformation in unbeaten pulp is overcome at about 3000 pounds. Beating decreases the pressure required to deform the fibers.

(7) Pressures up to 3000 pounds per square inch cause fiber deformation and the flow of free water. At approximately 3000 pounds both of these resistances are overcome and higher pressures force out capillary water.

(8) Determining the per cent water retained by pulp pressed at 4000 pounds pressure per square inch for 10 minutes gives a good measure of beating changes for drastically beaten or gelatinized pulp.

(9) Determining the per cent water retained in a sheet couched from a standard sheet machine gives a good index of its degree of beating.

### Acknowledgement

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# Review Of Paper Industry Literature

**Copies of United States Patents can be obtained from the United States Patent Office, Washington, D. C. for 10 cents each. Send currency, not stamps.**

### Specialties

**Method and Apparatus for Tearing Corrugated Paper.** Herman Ringel. U. S. pat. 2,149,169 (March 7, 1939).—A knife is mounted on a suitable support, and behind and below the knife is a pivoted counterweighted plate which normally bears against the knife edge and which serves three purposes: to guide the paper, to protect the operator's fingers, and to yieldably urge the paper into contact with the knife during the cutting operation.—A.P.-C.

**Multistage Creping Apparatus.** William H. Cannard. U. S. pat. 2,141,809 (Dec. 27, 1938).—The material to be treated is initially passed through one or more stages of coacting sets of traveling belts which transversely crowd the material and form longitudinal corrugations therein. Thereafter the material is passed between corrugating rolls designed to produce a final set of corrugation of the desired character.—A.P.-C.

**Method and Apparatus for Crimping Sheet Material.** Rudolf Haas, assignor of one-half to Zellstofffabrik Waldhof. U. S. pat. 2,141,432 (Dec. 27, 1938).—The apparatus substantially comprises a deformable body which is formed by a stack of laminations, against the edges of which the paper is pressed by mechanical, hydraulic or pneumatic pressure applying means and which, while the pressure is maintained, can be brought close together so that the surface of the deformable body, and hence the paper, is shortened in the desired direction. If paper which has already been crimped is subjected to this treatment, a double crimping is obtained.—A.P.-C.

**Process and Apparatus for Varying the Width of Paper Webs, in Particular for the Longitudinal Creping of Paper.** Rudolf Haas, assignor of one-half to Zellstofffabrik Waldhof. U. S. pat. 2,141,433 (Dec. 27, 1938).—The process consists in that the web is passed around part of the periphery of a body of revolution having a curved axis, and on this path is pressed against the body of revolution by special pressing means.—A.P.-C.

**Decalcomania Paper.** Ferdinand W. Humphner, assignor to Mid-States Gummed Paper Company. U. S. pat. 2,147,345 (Feb. 14, 1939).—A paper base having depressions in it is provided with a starch coating, an overlying gum coating and a lacquer coating over the gum, the lacquer being provided with complete lines of severance forming lacquer areas of predetermined shape, and the gum, starch and paper being provided with spaced cuts in alignment with the lines of severance (the lacquer areas being aligned vertically with the depressions).—A.P.-C.

**Decalcomania.** Ferdinand W. Humphner, assignor to Mid-States Gummed Paper Company. U. S. pat. 2,149,916 (March 7, 1939).—The patent covers a decalcomania paper comprising a water-leaf backing sheet containing dye in sufficient quantity to impart a distinctive color to the paper, and a coating of adhesive adapted to take decalcomania printing.—A.P.-C.

**Decorative Paper and Method of Making the Same.** Garrison Householder and Walter V. Shearer, assignors to the Beveridge-Marvellum Company. U. S. pat. 2,139,269 (Dec. 6, 1938).—A web of paper is coated with a varnish consisting of a crystallizable substance in a volatile solvent, and before any substantial evaporation takes place it passes under and is pressed by a roll having a design in relief.—A.P.-C.

**Processing Tissue Paper For Cigarettes.** James I. Gardiner and John Barnes, assignors of one-third to Charles F. W. Nichols. U. S. pat. 2,147,889 (Feb. 21, 1939).—Cigarette paper is treated with an aqueous solution of albumin and then dried and smoothed, the albumin serving to retard combustion.—A.P.-C.

**Composite Paper Sheet Material Suitable for Decorative Purposes.** Leslie R. Schroeder, assignor to American Tissue Mills. U. S. pat. 2,148,176 (Feb. 21, 1939).—The product comprises a corrugated

layer having alternate hills and valleys transversely disposed, and a sheet secured thereto (as by adhesive) having relatively flat portions on sets of adjacent hills and intermediate portions extending downwardly into some of the valleys.—A.P.-C.

**Esterifying Paper.** Le Matériel Téléphonique. Fr. pat. 836,696 (April 15, 1938).—Standard Telephones and Cables, Ltd., and Archibald A. New. Brit. pat. 494,253 (Oct. 24, 1938).—Paper is treated at above 60 deg. C. with an esterifying agent that forms an ester of cellulose with a carboxylic acid containing 2 to 5 carbon atoms in quantity sufficient to esterify the paper fully, the duration of the treatment being at least 5 minutes, but limited so that the surface layers only of the fibers are esterified. The wet tensile strength of the paper is increased. The esterification treatment is noted preceded by any treatment with carboxylic acid. In an example, paper strips are immersed in a solution containing acetic acid, acetic anhydride, toluene and zinc chloride at 100 deg. to 120 deg. C. for 5 to 20 min.—A.P.-C.

**Process for the manufacture of fancy paper.** Dartex A. G. für Kautachuk Verarbeitung, Frankfurt a.M. Ger. pat. 655,782 (Nov. 17, 1935).—A colored, aqueous dispersion of caoutchouc is used as the design medium and if necessary hydrophile colloids such as casein, haemoglobin or polyacrilic acid esters are mixed therewith. In this manner sharp designs are obtained.—J.F.O.

**Filtration Paper for Coffee, Tea or Similar Infusions.** Schlupkothen & Voigt, Düsseldorf. Ger. pat. 655,783 (June 10, 1936).—The paper is made up from a mixture of alkaline reacting water dehardening agents, such as sodium silicate and sodium carbonate, as well as finely divided adsorption means such as activated charcoal. These papers are not detrimental to the penetration of the infusions.—J.F.O.

**Manufacture of Glass-Filled Paper.** N. V. Maats. tot Beheer en Exploit. van Octrooien. Brit. pat. 497,059 (June 8, 1937); addition to Brit. pat. 483,769.—Glass in the form of fibers, strands, or mats of fibers, threads, or woven fabrics is incorporated in the paper at the wet end of the paper machine. Decorative effects may be produced by coloring or metallising the glass.—A.P.-C.

**Greaseproof Container.** Jose B. Calva, assignor to General Products Corporation. U. S. pat. 2,122,907 (July 5, 1938).—The interior surface of a container such as one formed of laminated paper is coated with a continuous greaseproof film formed of animal glue, glycerin 0.1 to 5, formaldehyde 0.5 to 15, and water 2 to 15 parts, heated to a suitable temperature to render the film soluble.—A.P.-C.

**Fibrous Material Suitable for Making Gaskets.** Harold W. Greider and Marion F. Smith, assignors to The Philip Carey Manufacturing Co. U. S. pat. 2,133,694 (Oct. 18, 1938).—There is added to an aqueous asbestos suspension a dispersed waterproofing material and an emulsifying agent such as soap chips and (or) sodium silicate which, at the concentrations of the materials comprised in the pulp, is effective to prevent the formation of clots of the water-proofing material in the pulp. When such a pulp is diluted as by the addition of a substantial quantity of water, the effectiveness of the emulsifying agent is decreased, and the precipitation of the waterproofing material in the mixture is uniform about and among the asbestos fibers.—A.P.-C.

**Gummed Tape.** Hans F. Bauer, Jordan V. Bauer and Don M. Hawley, assignors to Stein, Hall Manufacturing Company. U. S. pat. 2,144,610 (Jan. 24, 1939).—A remoistening tape comprises a flexible strip of cellulosic material such as paper carrying a dried coating of a water-pervious adhesive consisting mainly of a British gum converted to a solubility of 70 to 95 per cent in water at 24 deg. C. and a dextrin content less than about 55 per cent intimately dispersed with about 3 to 20 per cent of urea based on the weight of the British gum, and about 1 to 10 percent of glycerin. Such composition, when moistened, develops tackiness and sets rapidly.—A.P.-C.

**Gummed Tape.** Ferdinand W. Humphner, assignor to Mid-State Gummed Paper Company. U. S. pat. 2,143,600 (Jan. 10, 1939).—A strip of paper is provided on one side with a layer of a water-soluble gum and its other side is united with a sheet of material such as paper impregnated with rubber deposited from latex, rubber deposited from an organic solvent being used to unite the layers.—A.P.-C.

**Insole.** Milton O. Schur and Frederick W. Vogel, assignors to Brown Company. U. S. pat. 2,148,999 (Feb. 28, 1939).—Insole stock consists of a three-ply laminated structure. The inner ply consists of a relatively stiff pulp-, fiber- or leather-board, impregnated with a relatively inelastic stiffening agent, while the outer plies are impregnated with an elastic binder (such as rubber latex) so as to be more pliable and easily extended and compressed than the inner ply.—A.P.-C.

**Electrical Insulating Material.** John K. Webb, assignor to International Electric Corporation. U. S. pat. 2,147,824 (Feb. 21, 1939).—Tapes, sheets or the like, of fibrous materials are impregnated with styrene or a styrene mixture, so as to fill the pores. The styrene is subsequently converted into polystyrene at high temperature while the fibrous material is immersed in a bath or liquid styrene or a styrene mixture, thereby preventing loss of styrene by volatilization during polymerization. The material is removed from the bath and subsequently treated to remove any surplus polystyrene.—A.P.-C.

**Insulating Paper.** Siemens-Schuckertwerke A.-G. Fr. pat. 829,889 (July 8, 1938).—A paper for insulating electric cables is made by introducing into a roller grinder sulphate cellulose of long fibers and highly cooked, capable of being bleached, in a state in which swelling has at least commenced but preferably in a completely swollen state. The cellulose is beaten only to 23 deg. to 30 deg. Schopper-Riegler.—A.P.-C.

**Midsoles of Leather Substitute.** Izador J. Novak, assignor to Raybestos-Manhattan, Inc. U. S. pat. 2,125,947 (Aug. 9, 1938)—A leather substitute for use as a midsole comprises a felted fibrous product exhibiting a relatively low degree of fiber hydration of wet-machine laminated construction associated with a bonding material consisting essentially of about 15 to 35% of rubber and about 5 to 15 per cent of water-insoluble soap such as a precipitated aluminum soap, the rubber being present as a continuous film surrounding the fibers and the product possessing the characteristics of having had the rubber incorporated by saturation of a wet fibrous web, such as one of cotton rag pulp.—A.P.-C.

**Lining Material.** M. F. Monbiot and J. R. E. Stoddart. Belg. pat. 429,141 (Aug. 31, 1938).—The product consists of a sheet of paper or of cellulose derivative provided with an impermeable coating consisting of cellulose nitrate, a resin (or the like), a wax and dicyclohexyl oxalate. The coating can also contain halogenated rubber.—A.P.-C.

# Imports of Paper and Paper Stock

## Giving Manifests of New York, Boston, Philadelphia and Other Ports of Newsprint, Wrapping, Writing, Coated, Blotting, Tissue, Strawboard, Wallboard, Cigarette Papers, Sulphite, Kraft and Ground Wood Pulp.

### NEW YORK IMPORTS

WEEK ENDING DECEMBER 23, 1939

SUMMARY

Cigarette paper ..... 6 pkgs., 25 cs.
Wall board ..... 150 bdls.
Newsprint ..... 2,428 rolls
Wrapping paper ..... 1 roll
Filter paper ..... 10 cs.
Filter pulp ..... 50 bls.
Surface baryta coated paper ..... 62 cs.
Surface coated paper ..... 153 cs.
Basic paper ..... 5 cs.
Photo paper and material ..... 220 cs.
Transparent paper ..... 4 cs.
Transfer paper ..... 32 cs.
Decalcomanias ..... 6 cs.
Pasteboard ..... 217 cs.
Cardboard tubes ..... 62 cs.
Miscellaneous paper ..... 605 rolls, 1 ble.

CIGARETTE PAPER

Max Speigel & Son, *Belvedere,* Barcelona, 6 pkgs.
National City Bank, *Ida,* Fiume, 25 cs.

WALLBOARD

Engles Millwork Co., ———, Gothenburg, 150 bdls.

NEWSPRINT

Perkins Goodwin & Co., *Herstein,* Sundsvall, 150 rolls.
Nolan Bowmall & Co., Inc., *Herstein,* Sundsvall, 81 rolls.
H. Reeve Angel & Co., Inc., *Esther Thorden,* Kotka, 452 rolls.
Jay Madden Corp., *Esther Thorden,* Kotka, 1,084 rolls.
Gilman Paper Co., ———, Gothenburg, 433 rolls.
Perkins Goodwin & Co., ———, Gothenburg, 228 rolls.

WRAPPING PAPER

Freedman & Slater, *Lafcomo,* Antwerp, 1 roll.

FILTER PAPER

Schneider Bros., *Black Condor,* Rotterdam, 10 cs.

FILTER PULP

H. Reifenberg, *Maasdam,* Rotterdam, 50 bls.

SURFACE BARYTA COATED PAPER

Dingelstedt & Co., *Maasdam,* Rotterdam, 62 cs.

SURFACE COATED PAPER

Gevaero Co. of America, *Maasdam,* Rotterdam, 73 cs.
Gevaert Co. of America, *Black Condor,* Antwerp, 80 cs.

BASIC PAPER

International F'd'g Co., *Maasdam,* Antwerp, 5 cs.

PHOTO PAPER AND MATERIAL

Gevaert Co. of America, *Jean Jadot,* Antwerp, 220 cs.

TRANSPARENT PAPER

M. J. Corbett & Co., *Lafcomo,* Rotterdam, 4 cs.

TRANSFER PAPER

Phoenix Shipping Co., *Maasdam,* Rotterdam, 32 cs.

DECALCOMANIAS

General Motors Overseas Operations, *Maasdam,* Rotterdam, 6 cs.

PASTEBOARD

American Express Co., *Belvedere,* Genoa, 217 cs.

CARDBOARD TUBES

International F'd'g Co., *Lafcomo,* Antwerp, 62 cs.

MISCELLANEOUS PAPER

Hensel Bruckman & Lorbacher, *Maasdam,* Rotterdam, 1 ble.
The Borregaard Co., Inc., ———, Gothenburg, 36 rolls.
National Pulp & Paper Co., ———, Gothenburg, 420 rolls.
T. Matchett, ———, Gothenburg, 151 rolls.

RAGS, BAGGINGS, ETC.

Rohner Gehrig & Co., *Jean Jadot,* Antwerp, 10 bags waste paper.
———, *Lafcomo,* Rotterdam, 15 bls. rags.
D. M. Hicks, Inc., *Lafcomo,* Antwerp, 271 bls. flax waste.
W. Steck & Co., *Lagcomo,* Antwerp, 173 bls. flax waste.
Darmstadt Scott & Courtney, *Lafcomo,* Antwerp, 138 bls. waste bagging, 88 bls. flax waste.
P. Silverman & Son, *Lafcomo,* Antwerp, 12 bls. rags.
E. J. Keller Co., Inc., *Lafcomo,* ———, 362 bls. bagging.
Irving Trust Co., *Black Condor,* Antwerp, 117 bls. bagging.
W. J. Green & Co., *Black Condor,* Antwerp, 140 bls. flax waste.
W. Steck & Co., *Black Condor,* Antwerp, 78 bls. flax waste.
———, *Belvedere,* Genoa, 400 bls. rags.
A. M. Schmidt & Co., *Ida,* Fiume, 4 pkgs. rags.
Continental Bank Trust Co., *Ida,* Trieste, 84 bls. old cotton rags, 199 bls. old bagging.

OLD ROPE

G. W. Millar & Co., Inc., *Lafcomo,* Rotterdam, 127 coils.

CASEIN

American British Chemical Supplies, *Jean Jadot,* Antwerp, 300 bags, 24,362 kilos.

GLUESTOCK, ETC.

Darmstadt Scott & Courtney, *Lafcomo,* Rotterdam, 681 bls. gluestock.
Darmstadt Scott & Courtney, *Black Condor,* Rotterdam, 41 bls. gluestock.
Trans-Atlantic Animal By Products Co., *Ida,* Trieste, 100 bags bone glue sheets, 400 bags hideglue sheets.

WOOD PULP

Gottesman & Co., ———, Gothenburg, 2,200 bls. dry sulphite.
American Express Co., *Black Condor,* Antwerp, 41 bls. wood pulp.
J. Andersen & Co., *Herstein,* Sundsvall, 2,400 bls. kraft sulphate, 400 tons.
Cellulose Sales Co., Inc., *Herstein,* Sundsvall, 990 bls. kraft sulphate, 165 tons; 1,340 bls. dry sulphite, 268 tons.
———, *Herstein,* Soderhamn, 3,400 bls. dry sulphate, 680 tons; 2,835 bls. dry sulphite, 567 tons.
Brown Bros., Harriman & Co., *Herstein,* Kramfors, 150 bls. dry sulphate, 27 tons; 5,270 bls. wet sulphite, 937 tons.
———, *Herstein,* Hernosand, 2,160 bls. dry sulphate, 360 tons.
Bank of New York, *Herstein,* Stockholm, 1,236 bls. dry mechanical pulp, 175 tons.
Goldman Sachs & Co., *Algier,* Gothenburg, 5,760 bls. dry sulphate.
Pulp Sales Corp., *Esther Thorden,* Kotka, 1,270 bls. prime strong sulphate, 300 bls. prime bleached sulphate.
M. Sone, ———, Gothenburg, 500 bls. wood pulp.
J. Andersen & Co., ———, Gothenburg, 1,500 bls. wood pulp, 2,125 bls. sulphite.
E. M. Sergeant Pulp & Chemical Co., ———, Gothenburg, 300 bls. sulphite.
Bulkley Dunton Pulp Co., Inc., ———, Gothenburg, 600 bls. dry sulphite.

WOOD PULP BOARDS

H. Fuchs & Son, ———, Gothenburg, 25 crates.
Fibre Products Man'f'g Co., ———, Gothenburg, 36 bls.

### ALBANY IMPORTS

WEEK ENDING DECEMBER 23, 1939

Cellulose Sales Co., Inc., *Herstein,* Sundsvall, 1,675 bls. dry sulphite, 320 tons.

Bulkley Dunton Pulp Co., Inc., *Herstein,* Sundsvall, 835 bls. dry sulphite, 167 tons.
Cellulose Sales Co., *Herstein,* Sundsvall, 2,250 bls. kraft sulphate, 375 tons.
———, *Herstein,* Soderhamn, 1,625 bls. dry sulpihte, 325 tons.
Bank of New York, *Herstein,* Hernosand, 4,080 bls. dry sulphite, 680 tons.

### BOSTON IMPORTS

WEEK ENDING DECEMBER 23, 1939

M. Sone, *Peiping,* Gothenburg, 198 bls. wood pulp.

### NEWPORT NEWS IMPORTS

WEEK ENDING DECEMBER 23, 1939

Bulkley Dunton Pulp Co., Inc., *Herstein,* ———, 840 bls. kraft sulphate, 140 tons.
Cellulose Sales Co., Inc., *Herstein,* Sundsvall, 990 bls. kraft sulphate, 165 tons.
———, *Herstein,* Soderhamn, 2,650 bls. dry sulphate, 530 tons.

### BALTIMORE IMPORTS

WEEK ENDING DECEMBER 23, 1939

M. Sone, *Kanangoora,* Gothenburg, 1,248 bls. wood pulp.
———, *Herstein,* Soderhamn, 2,975 bls. dry sulphate, 595 tons; 750 bls. dry sulphite, 150 tons.
Cellulose Sales Co., Inc., *Herstein,* Sundsvall, 1,810 bls. dry sulphite, 352 tons.
Atterbury Bros., Inc., *Herstein,* Sundsvall, 600 bls. dry wood pulp, 100 tons.
Parsons & Whittemore, Inc., *Herstein,* Sundsvall, 50 rolls newsprint.
Bulkley Dunton Pulp Co., Inc., *Herstein,* Sundsvall, 250 bls. dry sulphite, 50 tons.
Bank of New York, *Herstein,* Hernosand, 1,440 bls. dry sulphite, 240 tons; 1,800 bls. dry mechanical pulp, 300 tons.
———, *Herstein,* Hernosand, 1,680 bls. dry mechanical pulp, 280 tons; 1,200 bls. dry sulphate, 200 tons.
Jay Madden Corp., *Esther Thorden,* Kotka, 516 rolls newsprint.

### LOS ANGELES IMPORTS

WEEK ENDING DECEMBER 23, 1939

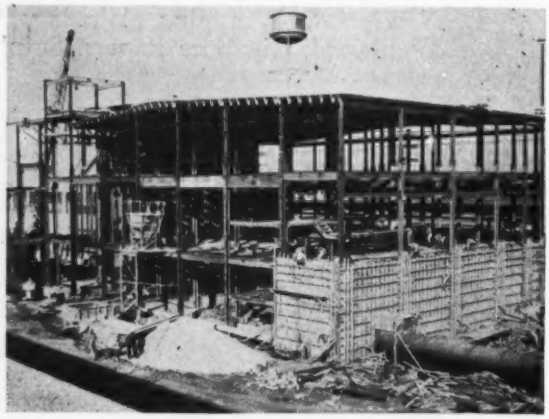
New Fashion Import Co., *Kanto Maru,* Kobe, 40 cases transparent paper.
New Fashion Import Co., *Kanto Maru,* Yokohama, 26 cs. transparent paper.
———, *West Ira,* Buenos Ayres, 97 tons old rags.
———, *Emma Bakke,* Gothenburg 9,000 bls. chemical sulphite, 1,510 tons.
———, *Emma Bakke,* Stockholm, 15,370 bls. chemical sulphite, 2,825 tons; 2,540 bls. unbleached pulp, 512 tons; 9,529 bls. ground bleached pulp, 1,705 tons.
———, *Korshamn,* Shanghai, 1,700 bls. rags.
———, *Kingsley,* Vancouver, 22 tons old rags.
———, *Eidsvold,* Kobe, 8 pkgs. hanging paper, 20 tons old rags.

## Uphold Duty on Filtering Discs

A long pending case involving the dutiability of tissue paper filtering discs, initiated in 1933, has been decided by the United States Court of Customs and Patent Appeals, in accordance with the position taken by the Import Committee of the American Paper Industry. The lower court ruled in faor of the importer, but the higher court on appeal reversed the United States Customs Court decision. The paper in question, imported from Japan as filtering paper, filtering paper circles and bibulous paper circles, was classified for duty at 30 per cent as paper cut into shapes. The importer claimed the proper classification was filtering paper, dutiable at 5 cents per pound and 15 per cent. Domestic manufacturers testified that such paper is not the filtering paper of commerce, but that it has a variety of uses. The Appellate Court upheld the 30 per cent classification.

## Progress on Champion's New Mill

The accompanying illustration shows the progress of construction of the new $3,500,000 paper mill of the Champion Paper and Fibre Company at Houston,



NEW CHAMPION MILL, NOVEMBER 20, 1939

Texas. This photograph looks toward the new beater room and was taken on November 20, 1939. The new mill of the Champion Paper and Fibre Company at Houston will be devoted to making coated papers.

## Newsprint Production Expands

[FROM OUR REGULAR CORRESPONDENT]

WASHINGTON, D. C., December 27, 1939—Canadian production and shipments of newsprint have shown definite improvement, according to a report from the Office of the American Commercial Attache, Ottawa. The average monthly production in the first 8 months of the year was 225,700 tons; shipments averaged 219,000 tons. In September production amounted to 253,230 tons, with a further increase to 280,985 tons in October. Furthermore, shipments have exceeded production, amounting to 267,000 tons in September and 289,260 tons in October.

Canadian newsprint mills have an annual rated capacity of 4,293,361 tons, on a 308-day operating basis. It does not follow, however, that the Dominion can produce that much tonnage. This figure was arrived at as a result of the best performance of mills over a comparatively short period of time. Consequently the sum mentioned represents the theoretical rather than tthe practical capacity of the industry. The largest volume of newsprint ever produced in the country was in 1937 when the output totaled 3,647,800 tons, which represented 93.9 per cent of the 3,838,000 tons of average capacity in that year. The rise in capacity since then has been in new machine installations and refinements in operation. During the first 8 months of the current year Canada produced 1,805,669 tons, or 63 per cent of capacity. There still is plenty of capacity to take care of a fairly broad expansion in demand.

## Geo. W. Millar & Co. Give Bonus

Geo. W. Millar & Co., Inc., paper merchants in New York since 1860, have announced a compensation bonus of one week's salary to all employees.

# Latest Review of Paper and Pulp Markets

## Production and Sales of Paper and Paper Board Continue At High Level — Orders and Shipments of Kraft Paper Top Production With Some Price Advances This Week — Mechanical and Chemical Pulp Prices Up.

Office of the PAPER TRADE JOURNAL.
Wednesday, December 27, 1939.

Sales volume in the wholesale paper market has levelled off, according to trade expectations, during the Christmas period. Reports from many manufacturers' representatives, jobbers, and general paper merchants, indicate that trade continues at a high and satisfactory level, with all factors reported as favorable for 1940.

Buying is reported as more cautious in the wholesale markets. Inventories are a little higher but not unduly large. The prevailing opinion in the paper industry in reference to the business prospects for next year is that production will be well maintained with a moderate increase in prices on most grades of paper and paper products. In some other industries, a slackening in output is looked for in the first two months of next year, with a rise in production and sales in most consumer goods during the spring, and a good volume of business throughout the year.

The index of general business activity declined to 105.4 per cent for the week ended December 17, from 106.6 per cent for the preceding week, compared with 93.7 per cent for the corresponding period last year. The index of employment, now at 103.8 per cent, is 11.3 per cent higher than for the current period last year, and payrolls are reported 20.6 per cent higher than last year for the like period.

Paper production of 154 mills for the week ended December 17 was estimated at 97.2 per cent, compared with 81.2 per cent for 1938, with 56.1 per cent for 1937, and with 93.3 per cent for the like week in 1936.

Paper board production for the week ended December 17 was 79.0 per cent, compared with 65.0 per cent in 1938, 51.0 per cent in 1937, and with 82.0 per cent for the like week in 1936.

Domestic consumption of newsprint, of all publishers, for November is estimated at 312,509 tons or 3.6 per cent higher than for the like month last year. Advertising linage for November in 52 cities showed a 0.1 per cent decline compared with the like month last year.

Orders for most grades of paper and paper products are reported at a high level for the current week, despite the seasonal slackening normally occurring during this period of the year, prior to inventory taking. The sales volume of most grades of sulphite papers, the medium grades of bond papers and in tissue papers, is reported equal to trade expectations. The demand for groundwood papers continues at a high level, and orders for various paper specialties are reported as excellent. No important change has been reported in the prices of any grade of white paper for the current week.

Kraft paper production continues at a high level with mills operating at practical capacity on a 6-day week schedule. Orders are currently running well above production and shipments are at a high level. Prices are firm with the average representative quotations higher on some grades. Northern Extra Quality kraft is currently quoted at from 5.00 to 5.50, Superstandard at from 4.62½ to 5.00, and Northern Standard at from 4.25 to 4.62½, delivered Zone A. Standard wrapping or Southern kraft is unchanged at 4.00.

The paper board market continues to show production and shipments at a high level, despite the seasonal decline during the current month. Container board volume continues high and kraft liner production continues at capacity, with a substantial amount of orders booked for future delivery. Prices are firm and unchanged on all grades of paper board.

### Mechanical Pulp

The heavy demand for mechanical pulp has created a very firm market and prices have been advanced on imported mechanical pulp. Moist imported pulp is currently quoted at from $35 to $40 per ton dry, at from $37.50 to $42.50 per ton, on dock. Quotations on domestic and Canadian pulps are unchanged at from $40 to $42 per ton, delivered.

### Chemical Pulp

Prices on all grades of chemical pulp are very firm. The trend is reported as upward and a shortage in the higher grades of unbleached sulphite is currently reported in some quarters of the trade. Prices have been advanced on many grades this week. Prime qualities of easy bleaching sulphite are currently quoted at 2.85, strong unbleached sulphite at 2.75. Kraft, light and strong, is currently quoted at from 1.95 to 2.35, and No. 1 graft pulp at from 1.85 to 2.20, on dock, Atlantic ports. No price changes have been reported on domestic kraft and on bleached soda pulp.

Three more ships, loaded with Finnish and Swedish wood pulp, consigned to this country, have been just released by Germany, twenty ships having been released to date.

### Old Rope and Bagging

The old rope market is reported as firm with trading showing no change in activity this week. Prices are unchanged.

No important change in activity or prices has been reported during this week on any grade of old bagging.

### Rags

Trading in the rag market this week is about at this rate of activity prevailing for several weeks past. No important change in prices has been reported, except on No. 2 roofing rags, which are currently quoted at from 1.20 to 1.27½. Trading in foreign rags continues at a low rate of activity this week, with shipping facilities continuing to hamper overseas trade.

### Old Waste Paper

Trading in the paper stock market is reported as moderately active with prices on many grades fairly firm and unchanged. Lower prices have been reported on solid flat book, currently quoted at from .80 to .90, and on strictly overissue news, currently quoted at from .47½ to .52⅓. No. 1 mixed paper is lower this week and currently quoted at from .32½ to .37⅓.

# Miscellaneous Markets

Office of the PAPER TRADE JOURNAL,
Wednesday, December 27, 1939.

BLANC FIXE—Quotations on blanc fixe are reported unchanged under a less active demand. The pulp is currently quoted at from $42.50 to $45 per ton, in bulk; the powder is offered at from 3½ to 3¾ cents per pound, in barrels, at works.

BLEACHING POWDER—Prices on bleaching powder are firm. Domestic demand is reported less active this week. Bleaching powder is currently quoted at from $2 to $2.85 per 100 pounds, in drums, at works.

CASEIN—Quotations on casein are unchanged for the current week. Standard domestic casein, 20-30 mesh, is quoted at 17 cents per pound; 80-100 mesh, at 17½ to 18 cents per pound. All prices in bags, car lots. Argentine casein, 20-30 mesh, is quoted at 14 cents per pound. Quotations on French casein, at from 14 to 14½ cents per pound, are nominal.

CAUSTIC SODA—Prices on caustic soda are firm under a good domestic and foreign demand. Solid caustic soda is currently quoted at from $2.30 to $2.40 per 100 pounds; flake and ground at from $2.70 to $2.95 per 100 pounds, in drums, at works.

CHINA CLAY—Quotations on china clay continue unchanged for the current week. Domestic filler clay is quoted at from $7 to $15 per ton. Coating clay at from $11 to $22 per ton at mines. Imported clay is offered at from $13.50 to $25 per ton, ship side.

CHLORINE—Prices on chlorine are firm under a steady demand at prevailing market quotations. Chlorine is currently quoted at $1.75 per 100 pounds, in single-unit tank cars, f.o.b., works.

ROSIN—The rosin market is reported firm for the week with no change in quotations. "G" gum rosin is currently quoted at $5.10 per 280 pounds, gross weight, in barrels, Savannah. "FF" wood rosin is quoted at $4.90 per 280 pounds, gross weight, in barrels, New York. Seventy per cent gum rosin size is offered at $2.78 per 100 pounds, f.o.b., shipping point.

SALT CAKE—Prices on salt cake are reported as very firm and practically nominal under a heavy demand. Current quotations range at from $15 to $19 per ton; chrome salt cake at from $15 to $16 per ton, f.o.b., shipping point. Prices on imported salt cake at $18 per ton are nominal.

SODA ASH—Quotations on soda ash are firm under a moderate demand and conform to prevailing market levels. Quotations on soda ash in car lots, at works, per 100 pounds, are as follows: in bulk, $.90; in bags, $1.10; and in barrels, $1.35.

STARCH—Quotations on corn starch are reported unchanged for this week. Globe pearl is currently quoted at $2.50 per 100 pounds; special paper starch at $2.60 per 100 pounds; all prices in bags, f.o.b., Chicago.

SULPHATE OF ALUMINA—Prices on sulphate of alumina are firm under a moderate demand. The commercial grades are currently quoted at $1.15; iron free at $1.45 per 100 pounds, in bags, car lots, f.o.b., works.

SULPHUR—Quotations on sulphur are firm under a moderate demand and conform to prevailing market prices. Annual contracts are currently quoted at $16 per long ton, f.o.b., mines. Spot and nearby car lots are quoted at $19 per ton.

TALC—Prices on talc are reported as firm under a moderate demand and are unchanged at prevailing market quotations. Domestic talc is currently quoted at from $15 to $18 per ton, Eastern mines. Imported talc is offered at from $23 to $45 per ton.

# Market Quotations

## Paper

(Delivered New York)

| | | | |
|---|---|---|---|
| News, per ton— | | | |
| Roll, contract | $50.00 | @ | — |
| Sheets | 58.00 | " | — |
| Kraft—per cwt.—Delivered Zone A | | | |
| Northern, Extra Quality | $5.00 | @ | $5.50 |
| Superstandard | 4.62½ | " | 5.00 |
| Northern Standard Wrapping | 4.25 | " | 4.62½ |
| Standard Wrapping | 4.00 | " | — |
| Tissues—Per Ream—Carlots | | | |
| White No. 1 | .87½ | @ | — |
| White No. 1 M. G. | .85 | " | — |
| White No. 1½ | .70 | " | — |
| White No. 2 | .65 | " | — |
| Anti-Tarnish M. G. | .75 | " | — |
| Colored | .80 | " | — |
| Kraft | .75 | " | — |
| Manila | .65 | " | — |
| Unbl. Toilet, 1 M. | 3.50 | " | — |
| Bleached Toilet | 5.26 | " | — |
| Paper Towels, Per Case— | | | |
| Unbleached, Jr. | 1.85 | @ | — |
| Bleached, Jr. | 3.20 | " | — |
| Manila—per cwt.—C. l. f. a. | | | |
| No. 1 Jute | 8.25 | @ | 10.25 |
| No. 1 Manila Wrapping, 35 lb. | 5.25 | " | — |
| No. 2 Manila Wrapping, 35 lb. | 5.00 | " | — |
| Boards, per ton— | | | |
| News | 45.00 | @ | — |
| Chip | 45.00 | " | — |
| Sgl. Mla. Lt. Chip | 57.50 | " | — |
| Jute Lined Chip | 57.50 | " | — |
| White Pat. Coated | 70.00 | " | — |
| Kraft Liners | 55.00 | " | — |
| Binders Boards | 76.00 | " | 87.00 |

The following are representative of distributors' resale prices:

Rag Content Bonds and Ledgers—White, Assorted Items, Delivered in Zone 1:

| | Bonds | | Ledgers | |
|---|---|---|---|---|
| 100% Rag Ext. No. 1. | $39.10 | @$46.00 | $40.25 | @$47.25 |
| 100% Rag | 31.05 | " 36.50 | 32.20 | " 37.75 |
| 85% Rag | .... | " .... | 29.90 | " 35.00 |
| 75% Rag | 23.60 | " 27.75 | 24.75 | " 29.00 |
| 65% Rag | .... | " .... | 21.65 | " 26.25 |
| 50% Rag | 17.55 | " 21.50 | 18.70 | " 22.75 |
| 25% Rag | 14.65 | " 17.75 | 15.80 | " 19.25 |

Colors at $1.00 cwt. extra.

Sulphite Bonds and Ledgers—White, Assorted Items, Delivered in Zone 1:

| | Bonds | | Ledgers | |
|---|---|---|---|---|
| No. 1 | $8.95 | @$11.00 | $10.10 | @$12.25 |
| No. 2 | 8.05 | " 9.75 | 9.25 | " 11.25 |
| No. 3 | 7.60 | " 9.25 | 8.50 | " 10.75 |
| No. 4 | 7.30 | " 9.00 | 8.50 | " 10.25 |

Colors $1.00 cwt. extra.

Free Sheet Book Papers—White, Cased Paper, Delivered in Zone 1:

| | | | |
|---|---|---|---|
| No. 1 Glossy Coated | $11.90 | @ | $13.50 |
| No. 2 Glossy Coated | 10.35 | " | 11.75 |
| No. 3 Glossy Coated | 9.55 | " | 11.00 |
| No. 4 Glossy Coated | 9.15 | " | 10.50 |
| No. 1 Antique (watermarked) | 8.35 | " | 9.50 |
| No. 2 Offset | 7.70 | " | 9.00 |
| A Grade E. F. | 7.50 | " | 8.75 |
| A Grade S. & S. C. | 7.75 | " | 9.00 |
| B Grade E. F. | 6.95 | " | 8.00 |
| B Grade S. & S. C. | 7.20 | " | 8.25 |
| C Grade E. F. | 6.65 | " | 7.75 |
| C Grade S. & S. C. | 6.90 | " | 8.00 |
| D Grade E. F. | 6.40 | " | 7.50 |
| D Grade S. & S. C. | 6.65 | " | 7.75 |

Ivory & India at $.50 cwt. extra.

## Mechanical Pulp

(On Dock, Atlantic Ports)

| | | | |
|---|---|---|---|
| No. 1 Imported— | | | |
| Moist | $35.00 | @ | 40.00 |
| Dry | 37.50 | " | 42.50 |

(Delivered)

| | | | |
|---|---|---|---|
| No. 1 Domestic and Canadian | 40.00 | @ | 42.00 |

## Chemical Pulp

(On Dock, Atlantic, Gulf and West Coast Ports)

| | | | |
|---|---|---|---|
| Bleached Sulphite (Domestic and Foreign)— | | | |
| Prime Bleached Sulphite | 3.00 | @ | 3.25 |
| Prime Qualities— | | | |
| Easy-Bleaching Sulphite | 2.85 | " | — |
| Strong Unbleached Sulphite | 2.75 | " | — |

(On Dock, Atlantic Ports)

| | | | |
|---|---|---|---|
| Kraft Bleached | 3.00 | @ | 3.25 |
| Kraft Light & Strong | 1.95 | " | 2.35 |
| Kraft No. 1 | 1.85 | " | 2.20 |

(F. o. b. Pulp Mill)

| | | | |
|---|---|---|---|
| Kraft Domestic | 1.60 | " | 2.12½ |

(Delivered)

| | | | |
|---|---|---|---|
| Soda Bleached | 2.90 | " | — |

Add 60 cents per short ton, dock charges for Albany; $2.50 for Lake Ports East and $3.50 for Lake Ports West of Mackinac Straits. Also add extra freight charges and war insurance to all quotations on imported pulp.

## Domestic Rags

### New Rags

(Prices to Mill f. o. b. N. Y.)

| | | | |
|---|---|---|---|
| Shirt Cuttings— | | | |
| New White, No. 1. | 7.50 | @ | 7.75 |
| Silesias No. 1 | 5.25 | " | 5.50 |
| New Unbleached | 7.75 | " | 8.00 |
| Blue Overall | 5.50 | " | 5.75 |
| Fancy | 2.50 | " | 3.00 |
| Washables | 2.15 | " | 2.25 |
| Mixed Khaki Cuttings | 2.75 | " | 3.00 |
| O. D. Khaki Cuttings | 3.00 | " | 3.25 |

### Old Rags

| | | | |
|---|---|---|---|
| White, No. 1— | | | |
| Repacked | 3.50 | " | 4.00 |
| Miscellaneous | 3.00 | " | 3.25 |
| White, No. 2— | | | |
| Repacked | 1.25 | " | 2.75 |
| Miscellaneous | 1.75 | " | 1.90 |
| Thirds and Blues— | | | |
| Repacked | 2.00 | " | 2.25 |
| Miscellaneous | 1.75 | " | 1.90 |
| Roofing Rags— | | | |
| No. 1 | 1.70 | " | 1.80 |
| No. 2 | 1.20 | " | 1.27½ |
| No. 3 (bagging) | 1.50 | " | 1.60 |
| No. 4 | .60 | " | .65 |
| No. 5A | .60 | " | .65 |

## Foreign Rags

All prices nominal.

### New Rags

| | | | |
|---|---|---|---|
| New Dark Cuttings | 2.25 | @ | 2.40 |
| New Mixed Cuttings | 2.00 | " | 2.20 |
| New Light Silesias | 5.50 | " | 5.75 |
| Light Flannelettes | 5.50 | " | 5.75 |
| New White Cuttings | 7.00 | " | 7.50 |
| New Light Oxford | 4.00 | " | 4.50 |
| New Light Prints | 3.00 | " | 3.25 |

### Old Rags

| | | | |
|---|---|---|---|
| No. 1 White Linens | 7.50 | " | 8.50 |
| No. 2 White Linens | 6.50 | " | 7.50 |
| No. 3 White Linens | 4.50 | " | — |

# HIGHEST QUALITY CLAYS

LUMP and POWDERED } IMPORTED

EASTON PAPER MAKERS IMPORTING CO. INC. EASTON, PENNSYLVANIA, U.S.A.

DOMESTIC { CRUDE CRUSHED, AIR FLOATED, WATER WASHED

## PRECIPITATED CALCIUM CARBONATE

## TAKO FILLER CLAY

A pure Kaolin— Opaque—

Extremely fine particle size—A clean, refined product, ALL under 10 microns—

HOLDS IN SUSPENSION
HIGH IN RETENTION

An Unlimited Supply — Inquiries Solicited

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BALTIMORE, MD.
Plant at HACKLEBURG, ALABAMA

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## POTDEVIN

HIGH-SPEED DRYING
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Varnish • Gum • Lacquer
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AUTOMATIC TEMPERATURE CONTROLLED
**DRYING OVENS**

Guaranteed average drying speed of 2,000 to 2,300 sheets (44"x64") per hour — automatic fed; hand fed — 1800 sheets per hour.

Fire-proof gas heat or efficient steam heat optional.

Gas, varnish, or lacquer fumes exhausted out of doors. Room temperature remains unchanged, air fresh and clean.

Write today for full details.

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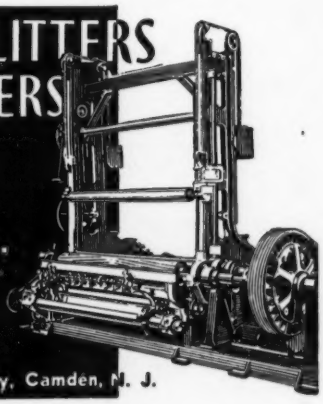
*Special Grades for Beater and Top Sizing*

Manufactured by
CLINTON COMPANY
CLINTON, IOWA

QUALITY SERVICE

## LANGSTON SLITTERS & ROLL WINDERS

produce
square-edged
dust-free rolls.



SHEAR CUT CLEAN CUT

Samuel M. Langston Company, Camden, N. J.

## WATERBURY FELTS

*Are Made By*

H. WATERBURY & SONS CO.
ORISKANY, NEW YORK

| | | | |
|---|---|---|---|
| No. 4 White Linens. | 2.25 | @ | 3.25 |
| No. 1 White Cotton. | 4.25 | " | 4.75 |
| No. 2 White Cotton. | 3.25 | " | 3.75 |
| No. 3 White Cotton. | 2.50 | " | 3.00 |
| No. 4 White Cotton. | 1.90 | " | 2.20 |
| Extra Light Prints.. | 2.00 | " | 2.40 |
| Ord. Light Prints... | 1.75 | " | 2.15 |
| Med. Light Prints... | 1.55 | " | 1.95 |
| Dutch Blue Cottons. | 2.25 | " | 2.50 |
| French Blue Linens.. | 3.00 | " | — |
| Checks and Blues... | 2.00 | " | — |
| Linsey Garments.... | 1.90 | " | 2.00 |
| Dark Cottons..... | 1.50 | " | 1.60 |
| Old Shopperies..... | 1.30 | " | 1.45 |
| New Shopperies..... | 1.45 | " | 1.50 |
| French Blues..... | 2.25 | " | 2.50 |

### Old Rope and Bagging

(Prices to Mill, f. o. b. N. Y.)

| | | | |
|---|---|---|---|
| Gunny No. 1— | | | |
| Foreign ..... | 2.50 | @ | 2.75 |
| Domestic ..... | 2.25 | " | 2.50 |
| Wool Tares, light... | 1.75 | " | 2.00 |
| Wool Tares, heavy.. | 1.80 | " | 1.90 |
| Bright Bagging..... | 2.25 | " | 2.50 |
| Manila Rope— | | | |
| Foreign ..... | 4.25 | " | 4.50 |
| Domestic ..... | 4.25 | " | 4.50 |
| Jute Threads..... | 3.00 | " | 3.25 |
| Sisal Strings..... | 2.00 | " | 2.25 |
| Mixed Strings..... | .70 | " | .85 |

### Old Waste Papers

(F. o. b. New York)

| | | | |
|---|---|---|---|
| Shavings— | | | |
| White Envelope Cuttings ..... | 2.75 | @ | 3.25 |
| Ordinary Hard White No. 1.... | 2.25 | @ | 2.50 |
| Soft White No. 1.. | 1.80 | " | 1.90 |
| Soft White Extra.. | 2.50 | " | 2.60 |
| Flat Stock— | | | |
| Stitchless ..... | 1.10 | " | 1.25 |
| Overissue Mag.... | 1.00 | " | 1.10 |
| Solid Flat Book... | .80 | " | .90 |
| Crumbled No. 1... | .70 | " | .75 |
| Ledger White Stock. | 1.55 | " | 1.65 |
| Ledger Stock Colored | 1.05 | " | 1.15 |
| Manila— | | | |
| New Env. Cut.... | 1.70 | " | 1.80 |
| New Cuttings..... | 1.40 | " | 1.50 |
| Old Kraft Machine— Compressed bales.. | 1.00 | " | 1.10 |
| News— | | | |
| No. 1 White News | 1.75 | " | 1.90 |
| Strictly Overissue. | .70 | " | .75 |
| Strictly Folded.... | .47½ | " | .52½ |
| Corrugated ..... | .60 | " | .65 |
| No. 1 Mixed Paper.. | .32½ | " | .37½ |

### Twines

(F. o. b. Mill)

(Soft Fiber)

| | | | |
|---|---|---|---|
| Coarse Polished— | | | |
| India ..... | .18½ | @ | — |
| White Hemp..... | .18½ | " | — |
| Fine Polished— | | | |
| Fine India..... | .23 | " | — |
| Unpolished— | | | |
| Box ..... | .14¾ | " | — |
| Paper Makers..... | .15 | " | — |
| Tube Rope..... | .16¼ | " | — |
| Wall Paper..... | .15¾ | " | — |
| Wrapping ..... | .18 | " | — |
| Soft Fiber Rope... | .16¼ | " | — |
| Cotton ..... | .21 | " | — |

(Hard Fiber)

| | | | |
|---|---|---|---|
| Medium Java..... | .19 | " | — |
| Mex. Sisal..... | .16 | " | — |
| Manila ..... | .24 | " | — |

## PHILADELPHIA

### Domestic Rags (New)

(Price to Mill, f.o.b. Phila.)

| | | | |
|---|---|---|---|
| Shirt Cuttings— | | | |
| New White No. 1. | .07¼ | @ | .07½ |
| New White No. 2. | .04 | " | .04½ |
| Light Silesias..... | — | " | .04½ |
| Silesias, No. 1.... | — | " | .04½ |
| Black Silesias, soft | — | " | .03¾ |
| New Unbleached.. | .05½ | " | .06 |
| Washable, No. 1.. | — | " | .04 |
| Blue Overall..... | — | " | .05 |
| Cottons—According to grades— | | | |
| Washable No. 2... | — | " | .02 |
| New Blue ..... | — | " | .02 |
| Fancy Percales.... | — | " | .03 |
| New Black Soft... | — | " | .04 |
| New Light Seconds | .04½ | " | .05 |
| New Dark Seconds | — | " | 1.50 |
| Khaki Cuttings— | | | |
| No. 1 O. D..... | .03½ | " | .04 |
| No. 2 Mixed..... | .03 | " | .03¼ |
| Corduroy ..... | — | " | .02½ |
| New Canvas..... | .05½ | " | .06 |
| New Black Mixed. | — | " | .03 |

### Domestic Rags (Old)

| | | | |
|---|---|---|---|
| White No. 1— | | | |
| Repacked ..... | 3.50 | @ | 4.00 |
| Miscellaneous .... | 2.75 | " | 3.00 |
| Thirds and Blues— | | | |
| Miscellaneous .... | 2.00 | " | 2.25 |
| Repacked ..... | 2.50 | " | 2.75 |
| Black Stockings (Export) ..... | 3.50 | " | 4.00 |
| Roofing Stock— | | | |
| Foreign No. 1....Nominal | | | |
| Domestic No. 1.. | 1.50 | " | 1.60 |
| Domestic No. 2... | 1.35 | " | 1.45 |
| Roofing Bagging.. | — | " | 1.30 |

### Bagging

(f.o.b. Phila.)

| | | | |
|---|---|---|---|
| Gunny, No. 1— | | | |
| Foreign .....Nominal | | | |
| Domestic ..... | 2.50 | @ | 3.00 |
| Manila Rope..... | — | " | 4.50 |
| Sisal Rope..... | 1.75 | " | 2.00 |
| Mixed Rope..... | 1.25 | " | 1.50 |
| Scrap— | | | |
| No. 1..... | 2.50 | " | 2.75 |
| No. 2..... | — | " | 1.40 |
| Wool Tares, heavy.. | 3.50 | " | 3.70 |
| Mixed Strings .... | .75 | " | 1.00 |
| No. 1 New Light Burlap ..... | 3.00 | " | 3.50 |
| New Burlap Cuttings | 2.00 | " | 2.25 |

### Old Papers

(f.o.b. Phila.)

| | | | |
|---|---|---|---|
| Shavings— | | | |
| No. 1 Hard Write | 2.25 | @ | 2.30 |
| No 2 Hard White | 2.00 | " | 2.10 |
| No. 1 Soft White | 1.85 | " | 1.90 |
| No. 2 Soft White | 1.50 | " | 1.60 |
| No. 1 Mixed..... | .90 | " | 1.00 |
| Solid Ledger Stock.. | 1.50 | " | 1.60 |
| Ledger Stock, white | 1.30 | " | 1.35 |
| Ledger Stock, colored | 1.00 | " | 1.10 |
| No. 1 Books, heavy.. | .90 | " | 1.00 |
| Manila Cuttings..... | 1.90 | " | 2.00 |
| Print Manila..... | .70 | " | .75 |
| Container Manila... | .65 | " | .70 |
| Kraft Paper..... | 1.00 | " | 1.10 |
| No. 1 Mixed Paper.. | .55 | " | — |
| Straw Board Chip.. | .50 | " | — |
| Binders Board Chip | .50 | " | — |
| Corrugated Board... | .60 | " | .65 |
| Overissue News..... | .70 | " | .75 |
| Old Newspapers..... | .55 | " | .60 |

## BOSTON

### Old Papers

(f.o.b. Boston)

| | | | |
|---|---|---|---|
| Shavings— | | | |
| No. 1 Hard White | 2.25 | @ | 2.50 |
| No. 1 Soft White | 1.85 | " | 2.15 |
| No. 2 Mixed..... | .75 | " | .80 |
| Solid Ledger Books.. | 1.30 | " | — |
| Overissue Ledger Stock ..... | 1.30 | " | 1.50 |
| Mixed Ledgers..... | .85 | " | .90 |
| No. 1 Books, heavy.. | 1.00 | " | 1.10 |
| No. 1 Books, light.. | .65 | " | .75 |
| Crumpled Stitchless Book Stock..... | .55 | " | .65 |
| Manila Env. Cuttings | 1.70 | " | 1.85 |
| Manila Envelope Cuttings, extra quality | 2.35 | " | 2.60 |
| White Blank News.. | 1.40 | @ | 1.50 |
| No. 1 Kraft..... | 1.10 | " | 1.20 |
| Mixed Papers..... | .40 | " | .45 |
| Print Manila..... | .70 | " | .75 |
| Container Manila... | .60 | " | .70 |
| Old Newspapers.... | .60 | " | .65 |
| Paper Wool Strings | .80 | " | .90 |
| Overissue News..... | .70 | " | .75 |
| Box Board Chips.... | .52½ | " | .55 |
| Corrugated Boxes.... | .60 | " | .62½ |
| Kraft corrugated boxes | 1.00 | " | 1.05 |
| Screening Wrappers | .60 | " | .70 |

### Bagging

(f.o.b.Boston)

| | | | |
|---|---|---|---|
| Manila Rope— | | | |
| Foreign ..... | 4.25 | @ | 4.50 |
| Domestic ..... | 4.00 | @ | 4.50 |
| Sisal Rope ..... | 2.25 | " | 2.50 |
| Mixed Rope ..... | .75 | " | 1.00 |
| Transmission Rope .. | 3.00 | " | — |
| Soft Jute Ropes..... | 3.25 | " | 3.50 |
| Jute Carpet Threads. | 1.25 | " | 1.50 |
| Gunny Bagging— | | | |
| Foreign ..... | 2.50 | " | — |
| Domestic ..... | 2.25 | " | 2.30 |
| Bleachery Burlap.... | 3.50 | " | 3.75 |
| Scrap Burlap— | | | |
| Foreign ..... | 2.40 | " | 2.50 |
| Domestic ..... | 1.90 | " | 2.00 |
| Scrap Sisal ..... | 2.25 | " | 2.35 |
| Scrap Sisal for Shredding ..... | 2.50 | " | 2.60 |
| Wool Tares, Heavy.. | 2.50 | " | 2.60 |
| New Burlap Cuttings | 3.25 | " | 3.50 |
| Aust. Wool Pouches. | 3.25 | " | 3.50 |
| Heavy baling bagging | 2.65 | " | 2.75 |
| Paper Mill Bagging.. | 1.25 | " | 1.50 |
| No. 2 Bagging ..... | 1.10 | " | 1.25 |

### Domestic Rags ( New)

(F. o. b. Boston)

| | | | |
|---|---|---|---|
| Shirt Cuttings— | | | |
| New Light Prints... | .03¼ | @ | .03½ |
| New White No. 1... | .08 | " | .08¼ |
| New Light Flannelettes ..... | .05 | " | — |
| Silesias No. 1 ..... | .05 | " | — |
| New Black Silesias.. | .03½ | " | .03¾ |
| Soft Unbleached.... | 7.50 | " | 8.00 |
| Blue Cheviots ..... | .05½ | " | .06 |
| Fancy ..... | .02 | " | .02½ |
| Washable ..... | .02 | " | .02½ |
| Cottons—According to grades— | | | |
| Blue Overalls .... | .05¼ | " | .05½ |
| New Black, soft .. | .03¼ | @ | .04 |
| Khaki Cuttings ..... | .02½ | " | .03 |
| O. D. Khaki ..... | .03 | " | .03¼ |
| Corduroy ..... | .02¾ | " | .03 |
| New Canvas..... | .06¾ | " | .07¼ |
| B. V. D. Cuttings... | .07 | " | .07½ |

### Domestic Rags (Old)

(F. o.b. Boston)

| | | | |
|---|---|---|---|
| Canvas ..... | .04¼ | @ | — |
| White No. 1— | | | |
| Repacked ..... | — | " | 2.75 |
| Miscellaneous ..... | 2.50 | " | 2.75 |
| White No. 2— | | | |
| Repacked ..... | 1.90 | " | 2.00 |
| Miscellaneous .... | 2.00 | " | 2.25 |
| Twos and Blues .... | 2.25 | " | 2.50 |
| Old Blue Overalls .. | 1.60 | " | 2.00 |
| Thirds and Blues— | | | |
| Repacked ..... | 2.00 | " | 2.25 |
| Miscellaneous .... | 1.50 | " | 1.60 |
| Black Stockings .... | 4.00 | " | 4.25 |
| Roofing Stock— | | | |
| No. 1..... | 1.75 | " | 2.00 |
| No. 2..... | 1.60 | " | 1.65 |
| No. 3..... | 1.00 | " | 1.25 |

### Foreign Rags

(F. o. b. Boston)

| | |
|---|---|
| Dark Cottons.....(nominal) | |
| Dutch Blues.....(nominal) | |
| New Checks and Blues(nominal) | |
| Old Fustians.....(nominal) | |
| Old Linsey Garments.(nominal) | |
| New Silesias.....(nominal) | |

## TORONTO

### Paper

### Bonds

Direct mill shipment in two-ton lots.

| | | | |
|---|---|---|---|
| N. 1 White .....$35.50 | @ | — | |
| No. 1 Tints ..... 36.50 | " | — | |
| No. 2 White ..... 25.50 | " | — | |
| No. 2 Tints ..... 26.50 | " | — | |
| No. 2 Golden Rod.. 27.50 | " | — | |
| No. 3 White ..... 21.00 | " | — | |
| No. 4 White ..... 15.00 | " | — | |
| No. 4 Tints ..... 16.00 | " | — | |
| No. 4 Golden Rod 17.00 | " | — | |

Direct mill shipment in three-ton lots.

| | | | |
|---|---|---|---|
| No. 5 White .....$10.50 | @ | — | |
| No. 5 Tints ..... 11.50 | " | — | |
| N. 5. Golden Rod.. 12.00 | " | — | |
| No. 6 White ..... 9.00 | " | — | |
| No. 6 Tints ..... 9.50 | " | — | |
| No. 6 Golden Rod.. 11.00 | " | — | |
| No. 7 White ..... 8.00 | " | — | |
| No. 7 Tints ..... 8.50 | " | — | |
| No. 7 Golden Rod.. 10.00 | " | — | |
| Book— | | | |
| No. 1 M. F. ..... $7.00 | " | — | |
| No. 2 M. F. ..... 6.50 | " | — | |
| No. 3 M. F. ..... 5.35 | " | — | |
| No. 1 S. C. ..... 7.25 | " | — | |
| No. 2 S. C. ..... 6.75 | " | — | |
| No. 3 S. C. ..... 5.85 | " | — | |

### Coated Book & Litho

Ton Lots (resale)

| | | | |
|---|---|---|---|
| No. 1 .....$12.00 | @ | — | |
| No. 2 ..... 10.25 | " | — | |
| No. 3 ..... 8.90 | " | — | |
| Coated tinted..... 13.00 | " | — | |
| Wrapping—delivered— | | | |
| Rag Brown..... 4.85 | " | 5.25 | |
| White Wrap..... 4.00 | " | — | |
| "B" Manila..... 4.90 | " | 5.15 | |
| No. 1 Manila.... $5.50 | @ | $6.90 | |
| Fiber ..... 5.50 | " | 6.90 | |
| Kraft No. 2..... 5.50 | " | 6.90 | |

(f.o.b. Cars, Toronto)

| | | | |
|---|---|---|---|
| News per ton— | | | |
| Rolls (contract).. | 46.00 | " | — |
| Sheets ..... | 54.00 | " | — |

### Pulp

| | | | |
|---|---|---|---|
| Ground wood.....$36.50 | @ | — | |
| Unbleached sulphite | 54.00 | " | — |
| Bleached sulphite... | 64.00 | " | — |
| Kraft ..... | 47.50 | " | — |
| Soda ..... | 58.00 | " | — |

### Old Waste Paper

(In carload lots, f.o.b. Toronto)

| | | | |
|---|---|---|---|
| Shavings— | | | |
| White Env. Cut.. | 2.15 | @ | — |
| Soft White..... | 2.00 | " | 2.15 |
| White Blk. News.. | 1.35 | " | 1.50 |
| Book and Ledger— | | | |
| Flat Magazine and Book Stock (old) | .90 | " | 1.00 |
| Light and Crumpled Book Stock..... | .80 | " | .90 |
| Ledgers and Writings ..... | 1.15 | " | — |
| Manilas— | | | |
| New Manila Cut.. | 1.55 | " | 1.60 |
| Printed Manilas... | .77 | " | — |
| Kraft ..... | 1.15 | " | — |
| News and Scrap— | | | |
| Strictly Overissue | .75 | " | — |
| Strictly Folded .. | .70 | " | — |
| No. 1 Mixed Paper | .60 | " | — |

## CHICAGO

### Waste Paper

(f.o.b. Chicago)

| | | | |
|---|---|---|---|
| Shavings— | | | |
| No. 1 White Envelope cuttings.. | 2.40 | @ | — |
| No. 1 Hard White | 2.23 | " | — |
| No. 1 Soft White | 2.00 | " | — |
| Ledger and Writings | 1.20 | " | — |
| Solid Books..... | .95 | " | — |
| Blanks ..... | 1.70 | " | — |
| Krafts ..... | 1.00 | " | — |
| New Kraft Cuts..... | 1.60 | " | — |
| Overissue News..... | .80 | " | — |
| Old Newspapers— | | | |
| No. 1 Folded News | .73 | " | — |
| No. 1 Mixed Paper | .63 | " | — |
| Roofing Stocks— | | | |
| No. 1 ..... | 1.25 | @ | — |
| No. 2 ..... | 1.15 | " | — |

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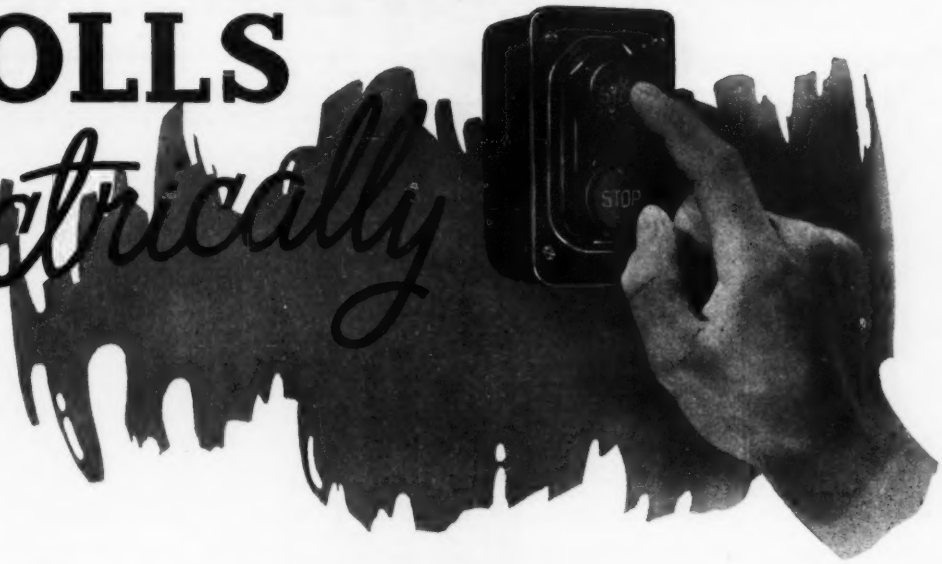


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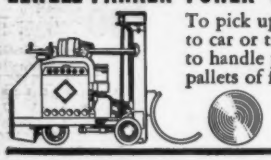

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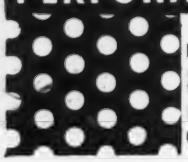

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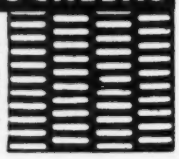

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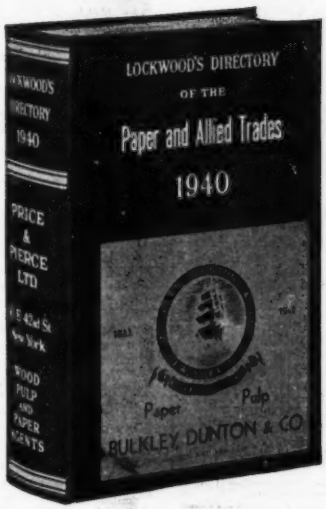


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Noble & Wood Machine Co.
Shartle Brothers Machine Co.
Valley Iron Works Co.

**BEATER BARS**
Dilts Machine Works, Inc.
International Nickel Co.
E. D. Jones & Sons Co.
Noble & Wood Machine Co.
Shartle Brothers Machine Co.
Valley Iron Works Co.

**BEATER HOODS**
Dilts Machine Works, Inc.
E. D. Jones & Sons Co.
The Noble & Wood Machine Co.
Shartle Brothers Machine Co.

**BEATER ROLLS**
Dilts Machine Works, Inc.
E. D. Jones & Sons Co.
Noble & Wood Machine Co.
Shartle Brothers Machine Co.
Valley Iron Works

**BEATER STOCK RECORDERS**
Bristol Co., The
The Foxboro Company
Taylor Instrument Companies

**BED PLATES**
Dilts Machine Works, Inc.
Downingtown Mfg. Co.
E. D. Jones & Sons Co.
Noble & Wood Machine Co.
Shartle Brothers Machine Co.
Valley Iron Works

**BELT COUPLINGS**
Greene, Tweed & Co.

**BELTING (Conveyor, Transmission and V)**
Cincinnati Rubber Mfg. Co.
Goodyear Tire & Rubber Co.
The Manhattan Rubber Mfg. Div. of Raybestos-Manhattan, Inc.
Rhoads & Sons, J. E.

**BLACK LIQUOR STRENGTH RECORDOR (Operates Signals)**
Leeds & Northrup Co.

**BLACK LIQUOR FLOW METERS**
The Foxboro Company
Mason-Neilan Regulator Co.
Taylor Instrument Companies

**BLEACHING APPARATUS**
E. D. Jones & Sons Co.
Perkins & Sons, Inc., B. F. Moore & White Co.
The Noble & Wood Machine Co.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.

**BLEACHING POWDER**
Amer. Cyanamid & Chem. Corp.
Electro Bleachine Gas Co.
Paper Makers Chemical Division, Hercules Powder Co.
Pennsylvania Salt Mfg. Co.

**BLEACHING PROCESS**
Electro Bleachine Gas Co.
Pennsylvania Salt Mfg. Co.
The Sandy Hill Iron & Brass Works

**BLOW PIPES**
The Hauser-Stander Tank Co.
Moore & White Co.
Murray Mfg. Co., D. J.
Perfecting Service Corp.

**BLOW PITS**
Murray, D. J. Mfg. Co.
Valley Iron Works

**BLOWERS (Centrifugal)**
De Laval Steam Turbine Co.
Ross Engineering Corp., J. O.

**BOARD FORMING MACHINES**
The Noble & Wood Machine Co.
Oliver United Filters, Inc.
The Sandy Hill Iron & Brass Works

**BOTTOMS (Steel & Wood)**
Harrington & King Perforating Co.
Kalamazoo Tank & Silo Co.

**BRASS AND COPPER PRODUCTS (Rod, Wire, Sheet, Tube and Plates, Pipe, Water Tube)**
Chase Brass & Copper Co.

**BRIDGES (Electrical)**
Leeds & Northrup Company

**BRONZE RODS**
Chase Brass & Copper Co.

**BUCKETS (Elevating)**
Chain Belt Company
Hendrick Mfg. Co.
Link-Belt Co.

**BUILDING CONSTRUCTION**
Merritt-Chapman & Scott Corp.

**BUSHINGS**
Chase Brass & Copper Co.
Manhattan Rubber Mfg. Co. Division of Raybestos-Manhattan, Inc.
The Sandy Hill Iron & Brass Works

**CADMIUM REDS**
Chemical & Pigment Co.

**CADMIUM YELLOWS**
Chemical & Pigment Co.

**CALENDERS**
Beloit Iron Works
Black-Clawson Company
Davis, Frank H., Co.
Downingtown Mfg. Co.
Farrel-Birmingham Co.
Lobdell Car Wheel Co.
Moore & White Co.
Perkins & Son, Inc., B. F.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Smith & Winchester Mfg. Co.
The Textile-Finishing Mchy. Co.
Valley Iron Works
Waldron Corp., John

**CALENDER ROLLS**
Appleton Machine Co.
Beloit Iron Works
Black-Clawson Co.
Farrel-Birmingham Co.
Lobdell Car Wheel Co.
The Manhattan Rubber Manufacturing Division of Raybestos-Manhattan, Inc.
Perkins & Son, Inc., B. F.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
The Textile-Finishing Mchy. Co.
Waldron Corp., John

**CALIPERS (Micrometer)**
Farrel-Birmingham Co.
Lobdell Car Wheel Co.

**CAMERAS (Photomicrographic)**
Bausch Lomb Optical Co.

**CAPACITORS**
General Electric Company

**CARBON TETRACHLORIDE**
American Cyanamid & Chemical Corp.
Pennsylvania Salt Mfg. Co.

**CASEIN**
Amer. Cyanamid & Chem. Corp.
Casein Co. of America
Paper Makers Chemical Corp.

**CASTINGS**
Appleton Machine Co.
Beloit Iron Works
Black-Clawson Company
Chain Belt Company
Downingtown Mfg. Co.
Farrel-Birmingham Co.
The Frederick Iron & Steel Co.
Hamblet Machine Co.
International Nickel Co.
E. D. Jones & Sons Co.
Link Belt Co.
Lobdell Car Wheel Co.
Montague Machine Co.
The Noble & Wood Machine Co.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Smith & Winchester Mfg. Co.

**CAUSTIC SODA**
American Cyanamid & Chemical Corp.
Columbia Alkali Corp.
Electro Bleaching Corp.
Paper Makers Chemical Division, Hercules Powder Co.
Pennsylvania Salt Mfg. Co.
Solvay Sales Corp.

**CEMENT (Acid Proof)**
Pennsylvania Salt Mfg. Co.

**CENTRIFUGAL MACHINERY**
Bird Machine Co.
De Laval Steam Turbine Co.
Shartle Brothers Machine Co.

**CHAIN DRIVES**
Chain Belt Company
Link-Belt Co.

**CHEMICAL FEED EQUIPMENT**
Leeds & Northrup Company
Wallace & Tiernan Co., Inc.

**CHEMICALS**
Amer. Cyanamid & Chem. Corp.
Chemical & Pigment Co.
The Columbia Alkali Corp.
E. I. du Pont de Nemours & Co., Inc.
Electro Bleachine Gas Co.
General Dyestuff Corp.
Geigy Co., Inc.
N. Y. Color & Chemical Co.
Paper Makers Chemical Division, Hercules Powder Co.
Pennsylvania Salt Mfg. Co.
Reichhold Chemicals, Inc.
Solvay Sales Corp.
Williams & Co., C. K.

**CHIPPERS**
Appleton Machine Co.
D. J. Murray Mfg. Co.
Valley Iron Works Co.

**CHLORINE**
American Cyanamid & Chemical Corp.
Columbia Alkali Corp.
Electro Bleachine Gas Co.
Pennsylvania Salt Mfg. Co.
Solvay Sales Corp.

**CHLORINE CONTROL APPARATUS**
Wallace & Tiernan Co., Inc.

**CHROME PLATE**
Chromium Corp. of America

**CHUCKS**
John Waldron Corp.

**CLAY**
Amer. Cyanamid & Chem. Corp.
C. P. Robinson
English China Clays Sales Corp.
International Pulp Co.
Paper Makers Importing Co.
Thomas Alabama Kaolin Co.
Vanderbilt Co., R. T.

**CLEANING MATERIALS**
Amer. Cyanamid & Chem. Corp.
Bird Machine Co.
Paper Makers Chemical Division, Hercules Powder Co.
Pennsylvania Salt Mfg. Co.
Philadelphia Quartz Co.
Solvay Sales Corp.

**CLUTCHES**
Appleton Machine Co.
Beloit Iron Works
Black-Clawson Company
Chain Belt Company
Farrel-Birmingham Co.
Link-Belt Co.
Rodney Hunt Machine Co.
Moore & White Co.
D. J. Murray Mfg. Co.
The Sandy Hill Iron & Brass Works

**COAL & ASH HANDLING MACHINERY**
Chain Belt Company
Link-Belt Co.

**COATING MACHINERY**
Cameron Machine Co.
Moore & White Co.
Potdevin Machine Co.
Shartle Brothers Machine Co.
Waldron Corporation, John
Weber, Herman G.

**COATING MATERIALS**
American Cyanamid & Chemical Corp.
Paper Makers Chemical Division, Hercules Powder Co.
Reichhold Chemicals, Inc.

**COCKS, Lubricated**
Crane Co.

**COGS**
Bowsher, N. P., The

**COLORIMETERS**
Bausch & Lomb Optical Co.

**COLOR ANALYZERS**
General Electric Co.

**COLOR MIXING EQUIPMENT**
The Noble & Wood Machine Co.
Shartle Brothers Machine Co.
Waldron, John, Corp.

**COLORS & PIGMENTS**
Reichhold Chemicals, Inc.

**COMBINING MACHINE**
Shartle Brothers Machine Co.
Waldron, John, Corp.

**COMBUSTION CONTROL SYSTEMS**
Leeds & Northrup Company

**COMPENSATORS**
General Electric Company

**COMPRESSORS**
Delaval Steam Turbine Co.
Nash Engineering Co.

**CONDENSER TUBES**
Chase Brass & Copper Co.

**CONDUCTIVITY RECORDERS**
Leeds & Northrup Company

**CONTRACTORS**
Merritt-Chapman & Scott Corp.

**CONTROLLING INSTRUMENTS**
Bristol Co., The
Foxboro Company
General Electric Co.
Leeds & Northrup Company
Mason-Neilan Regulator Co.
Taylor Instrument Companies

**CONVEYOR BELTS**
Chain Belt Company
Cincinnati Rubber Mfg. Co.
The Goodyear Tire & Rubber Co., Inc.
Link Belt Co.
The Manhattan Rubber Manufacturing Division of Raybestos-Manhattan, Inc.

**CONVEYORS (Broke)**
Black-Clawson Company

**CONVEYOR CHAINS**
Chain Belt Company
Link-Belt Co.

**CONVEYORS**
Chain Belt Company
Jeffrey Mfg. Co.
Link-Belt Co.
Murray, D. J. Mfg. Co.
Ross Engineering Corp., J. O.

**COOKING AND RECOVERY PROCESS**
E. D. Jones & Sons Co.
Murray Mfg. Co., D. J.
Ross Engineering Corp., J. O.

**COOLERS**
Ross, J. O. Mfg. Co.

**COPPER TUBES**
Chase Brass & Copper Co.

**CORES (Paper)**
Elixman Paper Co.
Sonoco Products Co.

**CORES (Steel)**
Rodney Hunt Machine Co.
Smith & Winchester Mfg. Co.

**COUCH ROLLS**
American Wringer Co.
Appleton Machine Co.
Beloit Iron Works
Black-Clawson Company
Cincinnati Rubber Mfg. Co.
Downingtown Mfg. Co.
Moore & White Co., The
The Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc.
Rodney Hunt Machine Co.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Montague Machine Co.
D. J. Murray Mfg. Co.
Stowe-Woodward, Inc.
Valley Iron Works

**COUPLINGS**
Beloit Iron Works
Black-Clawson Company
Chain Belt Company

# WHERE TO BUY

De Laval Steam Turbine Co.
Farrel-Birmingham Co., Inc.
The Frederick Iron & Steel
E. D. Jones & Sons Co.
Link Belt Co.
Moore & White Co.
The Noble & Wood Machine Co.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Waldron Corp., John
Westinghouse Electric Mfg. Co.

**CRANES**
Baker Raulang Co.
Elwell Parker Electric Co.
Harnishfeger Corp.
Link-Belt Speeder Corp.

**CREPING MACHINES**
Beloit Iron Works
The Cannard Company
Hudson Sharp Machine Co.
Paper Converting Machine
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
John Waldron Corp.

**CUTTERS**
Beloit Iron Works
Black-Clawson Company
Cameron Machine Co.
Davis, Frank H., Co.
Downingtown Mfg. Co.
Hamblet Machine Co.
Moore & White
Hudson Sharp Mch. Co.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Smith & Winchester Mfg. Co.

**CYLINDER MACHINES**
Beloit Iron Works
Black-Clawson Company
Davis, Frank H., Co.
Dowingtown Mfg. Co.
Moore & White Co.
Pusey & Jones Corp.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Valley Iron Works

**CYLINDER WIRES**
Appleton Wire Works
International Nickel Co.
International Wire Works
Lindsay Wire Weaving Co.

**DAMPENERS**
Perkins & Son, Inc., B. F.
Valley Iron Works

**DAMPER REGULATORS**
The Foxboro Company
Mason-Neilan Regulator Co.

**DECKERS**
Appleton Machine Co.
Bird Machine Company
Montague Machine Co.
Moore & White Co.
D. J. Murray Mfg. Co.
Oliver United Filters, Inc.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Valley Iron Works

**DECKLE STRAPS**
Shartle Brothers Machine Co.
Stowe-Woodward, Inc.

**DEFOAMERS**
American Cyanamid & Chemical Corp.
Heller & Merz
National Oil Products Co.

**DIE CUTTERS**
Appleton Machine Co., The

**DIE PRESSES**
Harris-Seybold-Potter Co.

**DIGESTERS**
Pusey & Jones Corp.

**DIGESTER CONTROLS**
The Foxboro Company
Mason-Neilan Regulator Co.
Taylor Instrument Companies

**DIGESTER FITTINGS**
Murray, D. J., Mfg. Co.

**DOCK CONSTRUCTION**
Merritt-Chapman & Scott Corp.

**DOCTORS**
Beloit Iron Works
Bird Machine Company
Black-Clawson Company
Downingtown Mfg. Co.
Lobdell Carwheel Co.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Valley Iron Works

**DOCTOR BLADES**
Cincinnati Rubber Mfg. Co.
International Nickel Co.
The Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc.
The Sandy Hill Iron & Brass Works
Stowe-Woodward, Inc.

**DOCTOR BLADES (Bronze For)**
Black-Clawson Company
The Sandy Hill Iron & Brass Works
Shartle Machine Co.

**DRAINAGE SYSTEMS**
Crane Company
Shartle Bros. Mch. Co.
Stickle Steam Specialties Co.

**DREDGING**
Merritt-Chapman & Scott Corp.

**DRIERS**
Beloit Iron Works
Black-Clawson Company
Davis, Frank H., Co.
Link Belt Co.
Ross, J. O. Engineering Corp.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Waldron, John, Corp.

**DRIVES & DRIVE STANDS**
Beloit Iron Works
Bird Machine Co.
Black-Clawson Company
Chain Belt Company
Davis, Frank H., Co.
Downingtown Mfg. Co.
Farrel-Birmingham Co.
General Electric Company
Link-Belt Co.
Moore & White Co.
Murray, D. J. Mfg. Co.
The Noble & Wood Machine Co.
Pusey Jones Corp.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Valley Iron Works

**DRYING SYSTEMS**
Murray Mfg. Co., D. J.
Ross Engineering Corp., J. O.
Shartle Bros. Mch. Co.
Stickle Steam Specialties
Waldron Corporation, The

**DUAL PRESS (Horizontal)**
Beloit Iron Works

**DUSTERS**
Appleton Machine Co.
Downingtown Mfg. Co.
E. D. Jones & Son Co.
Moore & White Co.
The Noble & Wood Machine Co.
D. J. Murray Mfg. Co.

**DYESTUFFS & COLORS**
Ciba Company
E. I. du Pont de Nemours & Co.
Geigy Co., The
General Dyestuff Corp.
Heller & Merz
National Aniline & Chemical
N. Y. Color & Chemical Co.
Paper Makers Chemical Division, Hercules Powder Co.
Reichhold Chemicals, Inc.
C. K. Williams & Co.

**ELECTRIC EQUIPMENT**
General Electric Co.

**ELEVATORS (Portable)**
Link Belt Company

**EMBOSSING MACHINES**
Hudson Sharp Machine Co.
Paper Converting Machine Co.
The Textile-Finishing Mchy. Co.
John Waldron Corp.

**EMBOSSING ROLLS**
The Appleton Machine Co.
Hudson Sharp Machine Co.
B. F. Perkins & Son, Inc.
Roehlen Engraving Works Inc.
The Textile-Finishing Mchy. Co.
Waldron Corporation, John

**EMULSIONS, RESIN**
Reichhold Chemicals, Inc.

**ENGINEERS**
Ferguson, Hardy S.
Hardy, George F.
Johnson & Wierk, Inc.
O'Donaghue, Roderick
Stone & Webster Engrg. Corp.

**ENGINEERING CONSTRUCTION**
Merritt-Chapman & Scott Corp.
Stone & Webster Eng. Corp

**EVAPORATORS**
Murray, D. J., Mfg. Co.

**EXTRACTORS**
Bird Machine Company
Downingtown Manufacturing
E. D. Jones & Sons Co.
The Noble & Wood Machine Co.
Valley Iron Works Co.

**FANS**
General Electric Co.
B. F. Perkins & Son, Inc.
Ross Engineering Co., J. O.

**FAN CONTROLS (Ventilating)**
The Bristol Company
The Foxboro Company
Mason-Neilan Regulator Co.
Taylor Instrument Companies

**FELT CARRIER ROLLS**
American Wringer Co.
Appleton Machine Co.
Beloit Iron Works
Black-Clawson Company
Cincinnati Rubber Mfg. Co.
Downingtown Mfg. Co.
Rodney Hunt Machine Co.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Stowe-Woodward, Inc.
Valley Iron Works

**FELT CLEANERS**
Philadelphia Quartz Co.

**FELT CONDITIONERS**
Bird Machine Company
The Noble & Wood Machine Co.

**FELTS**
Appleton Woolen Mills
Asten-Hill Mfg. Co.
Draper Bros. Co.
Huyck & Son, F. C.
Knox Woolen Co.
Lockport Felt Co.
Mt. Vernon-Woodbury Mills Inc.
Orr Felt & Blanket Co.
Shuler & Benninghofen
Turner Halsey & Co.
Waterbury Felt Co.
H. Waterbury & Sons Co.

**FELT GUIDES**
Beloit Iron Works
Moore & White Co.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
John Waldron Corp.

**FELT TIGHTENER (Automatic)**
John Waldron Corp.

**FERRULES**
Chase Brass & Copper Co.

**FILTERS**
Moore & White Co.
Oliver United Filters, Inc.
J. O. Ross Engrg. Corp.

**FILTER WIRES**
International Nickel Co.

**FITTINGS PIPE (Plain end or flanged)**
Crane Co.

**FLEXIBLE SLICE**
E. D. Jones & Sons Co.
The Sandy Hill Iron & Brass Works

**FLOORING**
Hendrick Mfg. Co.
Norton Co.

**FLOW METERS**
Bristol Co., The
The Foxboro Company
Leeds & Northrup Company
Mason-Neilan Regulator Co.
Taylor Instrument Companies

**FLY BARS**
Black-Clawson Company
Dilts Machine Works, Inc.
Downingtown Mfg. Co.
Jones & Sons Co., E. D.
Noble & Wood Machine Co.
Shartle Brothers Machine Co.

**FOLDING AND INTERFOLDING MACHINES**
Hamblet Machine Co.
Hudson Sharp Machine Co.
Paper Converting Machine Co., Inc.
Waldron, John, Corp.

**FORMING MACHINES**
Downingtown Mfg. Co.
The Noble & Wood Machine Co.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.

**FOURDRINIER MACHINES**
Beloit Iron Works
Black-Clawson Company
Consolidated Products Co., Inc.
Davis, Frank H., Co.
Downingtown Mfg. Co.
Moore & White Co.
Pusey & Jones
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Smith & Winchester

**FREENESS RECORDERS**
Trimbey Machine Works

**FREQUENCY RECORDERS**
The Bristol Company
Leeds & Northrup Company
Taylor Instrument Companies

**FRICTION CALENDERS**
The Textile-Finishing Mchy. Co.

**FURNACE PRESSURE (Draft Control)**
The Bristol Company
The Foxboro Company
Leeds & Northrup Company
Mason-Neilan Regulator Co.

**GALVANOMETERS**
Foxboro Company
General Electric Co.
Leeds & Northrup Company

**GAS ANALYSIS EQUIPMENT $SO_2$ and $CO_2$ RECORDERS**
Leeds & Northrup Company

**GATES (Canal & Sluice)**
Rodney Hunt Machine Co.

**GEARS**
Beloit Iron Works
Black-Clawson Company
De Laval Steam Turbine Co.
Downingtown Mfg. Co.
Farrel-Birmingham Co.
E. D. Jones & Son Co.
Link-Belt Co.
Moore & White Co.
D. J. Murray Mfg. Co.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Smith & Winchester Mfg. Co.
Valley Iron Works
John Waldron Corp.

**GENERATORS**
De Laval Steam Turbine Co.
General Electric Co.

**GENERAL CONTRACTORS**
Merritt-Chapman & Scott Corp.
Stone & Webster, Inc.

**GLYCERINE**
Reichhold Chemicals, Inc.

**GRABS & GRAPPLES**
Link Belt Company

**GRANITE ROLLS**
Beloit Iron Works
Black-Clawson Company
The Noble & Wood Machine Co.
Downingtown Mfg. Co.
Perkins & Son, Inc., B. F.

**GRINDERS**
Covel-Hanchett Co.
The Sandy Hill Iron & Brass Works

**GRATING (Sidewalk)**
Hendrick Mfg. Co.
Norton Co.
The Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc.

**HAMMERS (Soft Faced)**
Greene, Tweed & Co.

**HANGERS**
Chain Belt Company
Crane Co.
Link Belt Co.

**HEATING AND VENTILATING SYSTEMS**
Crane Co.
General Electric Co.
Grinnell Company
D. J. Murray Mfg. Co.
Perfecting Service Corp.
Ross Engineering Corp., J. O.
Stickle Steam Specialties Co.

**HEAT-TREATING FURNACES**
Leeds & Northrup Company

**HIGH DENSITY THICKENERS**
Shartle Brothers Machine Co.

**HOISTS**
Appleton Machine Co.
Harnishfeger Corp.
Rodney Hunt Machine Co.
E. D. Jones & Sons Co.
Link Belt Co.

**HOSE (Air, Water, Suction, etc.)**
Cincinnati Rubber Mfg. Co.
Goodyear Tire & Rubber Co.
Manhattan Rubber Mfg. Co.
The Manhattan Rubber Manufacturing Division of Raybestos-Manhattan, Inc.

**HUMIDITY RECORDERS**
The Bristol Company
The Foxboro Company
Leeds & Northrup Company
Mason-Neilan Regulator Co.
Taylor Instrument Companies

**HYDRAULIC MACHINERY**
Farrel-Birmingham Co.

**INDICATORS AND INSTRUMENTS**
N. P. Bowsher
The Bristol Co.
The Foxboro Company
Cambridge Instrument Co.
General Electric Co.
Grinnell Company
Leeds & Northrup Company
Mason-Neilan Regulator Co.
Taylor Instrument Companies

**JORDANS**
The Appleton Machine Co.
E. D. Jones & Sons Co.
Noble & Wood Machine Co.
Shartle Brothers Machine Co.
Smith & Winchester Mfg. Co.
Valley Iron Works

**JORDAN FILLINGS**
Appleton Machine Co.
Davis, Frank H., Co.
International Nickel Co.
E. D. Jones & Sons Co.
Noble & Wood Machine Co.
Shartle Brothers Machine Co.
Smith & Winchester Mfg. Co.
Valley Iron Works

**K MONEL**
International Nickel Co.

**KNIFE GRINDERS**
Bridgeport Safety Emery Wheel Co.

**KNIVES**
Beloit Iron Works
Dilts Machine Works, Inc.
Hamblet Machine Co.
Harris-Seybold-Potter Co.
E. D. Jones & Sons Co.
Valley Iron Works

**LABELLING MACHINES**
Potdevin Machine Co.

**LABORATORY EQUIPMENT**
Appleton Machine Co.
Dilts Machine Works
E. D. Jones & Sons Co.
Leeds & Northrup Company
Perfecting Service Corp.
Mine & Smelter Supply Co.
Noble & Wood Machine Co.
Taylor Instrument Companies
Valley Iron Works

**LATHES**
Montague Machine Co.

**LAY BOYS**
Hamblet Machine Co.
Moore & White Co.

**LIGHTING EQUIPMENT (Electric)**
General Electric Company

# WHERE TO BUY

**LIQUID LEVEL RECORDERS**
The Foxboro Company
Leeds & Northrup Company
Mason-Neilan Regulator Co.
Taylor Instrument Companies
**LITHOPONE**
Chemical & Pigment Co.
New Jersey Zinc Co.
**LIQUEFYING AGENTS**
Wallerstein Co., Inc.
**LOAD (Electrical) Control**
Leeds & Northrup Company
**LOFT DRYERS**
Ross Engineering Corp., J. O.
Perfecting Service Corp.
Valley Iron Works
John Waldron Corp.
**LUBRICANTS**
Gulf Refining Co.
Shell Union Oil Co.
Socony-Vacuum Oil Co., Inc.
Tide Water Associated Oil Co.
**MACHINERY ERECTION**
Merrit-Chapman & Scott Corp.
**MAGNIFIERS (Pocket)**
Bausch & Lomb Optical Co.
**MARKING BANDS (Rubber)**
Cincinnati Rubber Mfg. Co.
Stowe-Woodward, Inc.
**MEASURING INSTRUMENTS**
The Bristol Company
The Foxboro Company
Leeds & Northrup Company
Mason-Neilan Regulator Co.
Taylor Instrument Companies
**METERS**
The Bristol Co.
The Foxboro Company
Leeds & Northrup Company
Mason-Neilan Regulator Co.
Taylor Instrument Companies
**METERING & PROPORTIONING SYSTEMS**
The Bristol Company
The Foxboro Company
Mason-Neilan Regulator Co.
Merrick Scale Mfg. Co.
Taylor Instrument Companies
Trimbey Machine Works
**MICROMETERS**
Farrel-Birmingham Co.
Lobdell Car Wheel Co.
Montague Machine Co.
**MICRO-PROJECTORS**
Bausch & Lomb Optical Co.
**MICROSCOPES**
Bausch & Lomb Optical Co.
**MIXERS**
Link Belt Company
Waldron Corp., John
**MONEL METAL (Covered Rolls)**
The International Nickel Co.
**MONEL METAL (Rolled Forms)**
The International Nickel Co.
**MOTORS**
General Electric Co.
**NAPKIN FOLDING MACHINE**
Hudson Sharp Machine Co.
Paper Converting Machine Co., Inc.
Waldron, John, Corp.
**NICKEL-CLAD STEEL**
The International Nickel Co.
**NICKEL IRON ALLOYS**
The International Nickel Co.
**OPACIFYING PIGMENT**
Chemical & Pigment Co.
New Jersey Zinc Co.
Titanium Pigment Co.
United Color & Pigment Co.
R. T. Vanderbilt Co.
**PACKING MACHINES**
Hudson Sharp Machine Co.
**PACKING**
Greene, Tweed & Co.
The Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc.
**PACKING BOXES**
Shartle Brothers
**PACKING (Specially Treated to Caustic Soda and Alkalies)**
Greene, Tweed & Co.
**PACKING (Rubber)**
Cincinnati Rubber Mfg. Co.
The Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc.
**PAPER MACHINE DRIER CONTROL SYSTEMS**
The Bristol Company
The Foxboro Company
Mason-Neilan Regulator Co.
Perfecting Service Corp.
Taylor Instrument Companies
**PAPER MANUFACTURERS**
West Virginia Pulp & Paper
**PAPER MACHINE HOODS**
Ross Engineering Corp., J. O.
Perfecting Service Corp.
**PAPER MACHINE SLICES**
Beloit Iron Works
Black-Clawson Company
E. D. Jones & Sons Co.
Montague Machine Co.
The Sandy Hill Iron & Brass Works
Valley Iron Works Co.
**PAPER ROLLS**
The Textile-Finishing Mchy Co.
B. F. Perkins & Son, Inc.
Waldron Corp., John
**PAPER TESTERS**
Perkins & Son, Inc., B. F.
Valley Iron Works
**PAPER TUBE MACHINERY**
Dietz Machine Works
Langston Co., Samuel M.
**PASTING MACHINES**
Beloit Iron Works
Black-Clawson Company
Davis, Frank H., Co.
Murray, D. J., Mfg. Co.
Moore & White Co.
Potdevin Machine Co.
Shartle Brothers Machine Co.
John Waldron Corp.
**PENSTOCKS**
Rodney Hunt Machine Co.
**PERFORATING MACHINES**
Dietz Machine Works
Waldron John, Corp.
**PERFORATED METAL**
Chase Brass & Copper Co.
Harrington & King Perforating Co.
Hendrick Mfg. Co.
**pH TESTERS AND CONTROL**
Leeds & Northrup Company
Wallace & Tiernan, Co., Inc.
**PILLOW BLOCKS**
Link Belt Company
Chain Belt Company
**PIPE**
Chase Brass & Copper Co.
Crane Co.
Grinnell Company
The International Nickel Co.
**PIPING CONTRACTORS**
Merritt-Chapman & Scott Corp.
**PLATING, CHROMIUM**
Chromium Corp. of America
**PLATERS**
Perkins & Son, Inc., B. F.
**PLAYING CARD MACHINERY**
Waldron, John, Corp.
**PLUGS**
Black-Clawson Company
E. D. Jones & Sons Co.
The Noble & Wood Machine Co.
Shartle Brothers Machine Co.
**POTENTIOMETERS**
The Foxboro Company
Leeds & Northrup Company
**POWER PLANTS**
Consolidated Products Co., Inc.
Johnson & Wierk, Inc.
Perfecting Service Corp.
**POWER TRANSMISSION EQUIPMENT**
Beloit Iron Works
Black-Clawson Company
Chain Belt Company
De Laval Steam Turbine Co.
Farrell-Birmingham Co.
Link-Belt Co.
Moore & White Co.
Murray, D. J.
The Sandy Hill Iron & Brass Works
**PRESSES**
Black-Clawson Company
Farrel-Birmingham Co.
Paper Converting Machine Co., Inc.
Potdevin Machine Co.
Shartle Brothers
Valley Iron Works
Waldron Corp., John
**PRESSES (Dual Suction)**
Beloit Iron Works
**PRESS ROLLS**
American Wringer Co., Inc.
Beloit Iron Works
Black-Clawson Company
Cincinnati Rubber Mfg. Co.
Downingtown Mfg. Co.
The Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc.
Montague Machine Co.
Perkins & Son, Inc., B. F.
Pusey & Jones Corp.
Rodney Hunt Machine Co.
The Sandy Hill Iron & Brass Works
Shartle Brothers
Stowe-Woodward, Inc.
Valley Iron Works
**PRESSURE BULKERS**
Perkins & Son, Inc., B. F.
**PRINTING PRESSES**
H. H. Heinrich, Inc.
Hudson Sharp Machine Co.
Potdevin Machine Co.
Paper Converting Machine Co., Inc.
John Waldron Corp.
Weber, Herman G.
**PULLEYS**
Beloit Iron Works
Black-Clawson Company
Chain Belt Company
Downingtown Mfg. Co.
E. D. Jones & Sons Co.
Horton Mfg. Co.
Link-Belt Co.
Montague Machine Co.
The Noble & Wood Machine Co.
D. J. Murray Mfg. Co.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Valley Iron Works
**PULP BINDERS**
Reichhold Chemicals, Inc.
**PULP MILL MACHINERY**
Bauer Brothers Co.
Montague Machine Co.
**PULPSTONES**
Norton Co.
**PULPS**
Anderson Co., J.
Bulkley Dunton Pulp Co., Inc.
Gottesman & Co., Inc.
Lagerloef Trading Co.
Perkins-Goodwin Co.
Price & Pierce, Ltd.
Pulp Sales Corporation
Pulp and Paper Trading Co.
Howard Smith Paper Mills, Ltd.
**PULPERS**
Bauer Brothers Co.
Bird Machine Co.
Dilts Machine Works, Inc.
Downingtown Mfg. Co.
E. D. Jones & Sons Co.
D. J. Murray Mfg. Co.
Noble & Wood Machine Co.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
**PULPWOOD STACKERS**
Link Belt Co.
**PUMP PRIMERS (Steam and Water Jet)**
Valley Iron Works Co.
**PUMP VALVE BALLS (Rubber)**
Stowe-Woodward, Inc.
**PUMPS**
Beloit Iron Works
Black-Clawson Company
Buffalo Pumps Inc.
Davis, Frank H., Co.
Dorr Company
Downingtown Mfg. Co.
Frederick Iron and Steel Co.
De Laval Steam Turbine Co.
Moore & White Co.
Nash Engineering Co.
The Noble & Wood Machine Co.
Oliver United Filters, Inc.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Smith & Winchester Mfg. Co.
Valley Iron Works
Warren Steam Pump Co.
**PYROMETERS (Roll)**
The Bristol Co.
Cambridge Instrument Co.
Leeds & Northrup Company
**RAG CUTTERS**
The Noble & Wood Machine Co.
Perkins & Son, Inc., B. F.
Taylor Stiles & Co.
**REAM COUNTERS**
Hamblet Machine Co.
**REAM TRIMMERS**
Harris-Seybold-Potter Co.
**RECORDING INSTRUMENTS**
The Bristol Co.
The Foxboro Company
General Electric Co.
Leeds & Northrup Company
Mason-Neilan Regulator Co.
Taylor Instrument Companies
Trimbey Machine Works
**RECOVERY SYSTEMS**
Rodney Hunt Machine Co.
Moore & White Co.
D. J. Murray Mfg. Co.
Pusey & Jones
Ross Engineering Corp., J. O.
**REELS**
Beloit Iron Works
Black-Clawson Company
Downingtown Mfg. Co.
De Laval Steam Turbine Co.
Hudson Sharp Machine Co.
Moore & White Co.
Paper Converting Mch. Co.
Rodney Hunt Machine Co.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
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Appleton Machine Co.
Bauer Brothers Co.
The Cannard Company
E. D. Jones & Sons Co.
Murray, D. J. Mfg. Co.
Noble & Wood Machine Co.
Shartle Brothers Machine Co.
Valley Iron Works
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Norton Co.
**REGULATORS**
The Bristol Co.
The Foxboro Company
General Electric Co.
Leeds & Northrup Company
Link Belt Company
Mason-Neilan Regulator Co.
The Noble & Wood Machine Co.
Taylor Instrument Companies
Trimbey Machine Works
**RESINS, SYNTHETIC**
Reichhold Chemicals, Inc.
American Cyanamid & Chemical Corp.
**ROD MILLS**
The Mine and Smelter Supply Co
Murray, D. J. Mfg. Co.
**ROLLS (Brass and Copper)**
Black-Clawson Company
H. M. Hillman
Rodney Hunt Machine Co.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
**ROLLS (Bronze)**
Rodney Hunt Machine Co.
**ROLLS (Chilled Iron & Gray Iron)**
Black-Clawson Company
Davis, Frank H., Co.
Farrel-Birmingham Co.
Lobdell Car Wheel Co.
Shartle Brothers Machine Co.
The Sandy Hill Iron & Brass Works
Smith & Winchester Mfg. Co.
The Textile-Finishing Mchy. Co.
Valley Iron Works
**ROLLS (Rubber or Rubber Covered)**
American Wringer Co.
Beloit Iron Works
Black-Clawson Company
Cincinnati Rubber Mfg. Co.
Davis, Frank H., Co.
Downingtown Mfg. Co.
Goodyear Tire & Rubber Co.
D. J. Murray Mfg. Co.
Rodney Hunt Machine Co.
The Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc.
Montague Machine Co.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.,
Stowe-Woodward, Inc.
The Textile-Finishing Mchy. Co.
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Rodney Hunt Machine Co.
**ROLL GRINDERS**
Farrel-Birmingham Co.
Lobdell Car Wheel Co.
Montague Machine Co.
**ROLL SLITTING MACHINES**
Cameron Machine Co.
Langston Co., Samuel M.
Potdevin Machine Co.
**ROLL STANDS**
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Moore & White Co.
Potdevin Machine Co.
Shartle Brothers Machine Co.
**ROLL WINDING MACHINES**
Cameron Machine Co.
Potdevin Machine Co.
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Varlean Iron Works
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The Hauser-Stander Tank Co.
Manhattan Rubber Mfg. Co.
The Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc.
Stowe-Woodward, Inc.
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**RUBBER VALVES (Ball)**
Shartle Brothers
Stowe-Woodward, Inc.
**SALT**
Pennsylvania Salt Mfg. Co.
Solvay Sales Corp.
**SALT CAKE**
American Cyanamid & Chemical Corp.
Gottesman Co.
Pennsylvania Salt Mfg. Co.
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The Noble & Wood Machine Co.
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Shartle Brothers Machine Co.
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Weber, Herman G.
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Dorr Company
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Moore & White Co.
Oliver United Filters, Inc.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
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**SCREEN DIAPHRAGMS**
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E. D. Jones & Sons Co.
Manhattan Rubber Mfg. Co.
The Manhattan Rubber Manufacturing Division of Raybestos-Manhattan, Inc.
The Sandy Hill Iron & Brass Works
Stowe-Woodward, Inc.
**SCREENS & SCREEN PLATE**
Appleton Wire Works

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Beloit Iron Works
Bird Machine Company
Chain Belt Company
Davis, Frank H., Co.
Dilts Machine Works, Inc.
Downingtown Mfg. Co.
Harrington & King Perforating Co.
Hendrick Manufacturing Co.
E. D. Jones & Sons Co.
Link-Belt Co.
Montague Machine Co.
Moore & White Co.
Charles Mundt & Sons
D. J. Murray Mfg. Co.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Trimbey Machine Wks.
Valley Iron Works Co.

**SECTIONAL DRIVES**
General Electrical Company

**SHAFTS**
E. D. Jones & Sons Co.
Moore & White
The Noble & Wood Machine

**SHEET MACHINE**
Noble & Wood Machine Co.

**SHEET METAL (Brass & Copper)**
Chase Brass & Copper Co.

**SHEAVES**
Montague Machine Co.

**SHELLS (Jordan)**
E. D. Jones & Sons Co.
The Noble & Wood Machine

**SHOWER PIPES**
Bird Machine Company
Downingtown Mfg. Co.
Moore & White Co.
Shartle Bros. Mch. Co.
Smith & Winchester Mfg. Co.

**SHREDDERS**
Bauer Brothers Co.

**SILICATE OF SODA**
American Cyanamid & Chemical Corp.
Philadelphia Quartz Co.

**SIZING**
American Cyanamid & Chemical Co.
National Oil Products
Paper Makers Chemical Division, Hercules Powder Co.
Reichhold Chemicals, Inc.

**SIZING PROCESS**
American Bewoid Co.
Bulkley-Dunton Pulp Co., Inc.
Glidden Company
Ross Engrg. Corp. J. O.

**SLIME ELIMINATION**
Wallace & Tiernan Co., Inc.

**SLITTERS**
Bagley & Sewall Mfg. Co.
Beloit Iron Works
Black-Clawson Company
Cameron Machine Co.
Dietz Machine Works
Downingtown Mfg. Co.
Hamblet Machine Co.
Langston Co., Samuel M.
Moore & White Co.
Potdevin Machine Co.
The Sandy Hill Iron & Brass Works
Smith & Winchester Mfg. Co.
Waldron Corporation, John

**SMOKE DENSITY INDICATING RECORDERS**
Leeds & Northrup Company

**SODA ASH**
American Cyanamid & Chemical Corp.
Columbia Alkali Corp.
Paper Makers Chemical Division, Hercules Powder Co.
Pennsylvania Salt Mfg. Co.
Solvay Sales Corp.

**SOAP POWDER**
Paper Makers Chemical Division, Hercules Powder Co.

**SODIUM METASILICATE**
Philadelphia Quartz Co.

**SODIUM SULPHATE**
American Cyanamid & Chemical Corp.
Pennsylvania Salt Mfg. Co.

**SORTING TABLES**
Moore & White Co.

**SPECIAL MACHINERY**
Appleton Machine Co.
Beloit Iron Works
Davis, Frank H., Co.
Dowingtown Mfg. Co.
Farrel-Birmingham Co.
Hamblet Machine Co.
Hudson Sharp Machine Co.
E. D. Jones & Sons Co.
Merrick Scale Mfg. Co.
Montague Machine Co.
D. J. Murray Mfg. Co.
The Noble & Wood Machine Co.
Paper Converting Machine Co., Inc.
Potdevin Machine Co.
Rodney Hunt Machine Co.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
John Waldron Corp.

**SPEED INDICATING RECORDERS**
The Bristol Company
Leeds & Northrup Company

**SPEED REDUCERS**
Beloit Iron Works
De Laval Steam Turbine Co.
Farrel-Birmingham Co.
Rodney Hunt Machine Co.
Link-Belt Co.

**SPROCKETS**
Chain Belt Company
Link-Belt Co.

**STAIR and FLOOR TILES—(Non-Slip)**
Norton Company

**STAIR TREADS**
Chase Brass & Copper Co.
Hendrick Mfg. Co.
Norton Company

**STARCH**
American Cyanamid & Chemical Corp.
Clinton Co.

**STEAM FITS & PACKING BOXES**
Perfecting Service Corp.
Shartle Brothers

**STEAM SPECIALTIES**
Crane Co.
Shartle Bros. Mch. Co.
Stickle Steam Specialties Co.

**STEEL**
International Nickel Co.
Timken Roller Bearing Co.

**STEEL PLATE CONSTRUCTION**
Hendrick Mfg. Co.
Link-Belt Co.
Ross Engrg. Corp., J. O.

**STOCK CUTTERS**
Perkins & Son, Inc., B. F.

**STOKERS**
The Frederick Iron & Steel
Link-Belt Co.

**STRAW MAKING MACHINERY**
Samuel H. Langston Co.

**STREAM POLLUTION**
Johnson & Wierk, Inc.

**STUFF CHESTS**
Downingtown Mfg. Co.
The Hauser-Stander Tank Co.
E. D. Jones & Sons Co.
Moore & White Co.
D. J. Murray Mfg. Co.
Noble & Wood Machine Co.
The Sandy Hill Iron & Brass
Shartle Brothers Machine Co.
Valley Iron Works Co.

**STUFF PUMPS**
Beloit Iron Works
De Laval Steam Turbine Co.
Downingtown Mfg. Co.
The Frederick Iron & Steel Co
Moore & White Co.
Noble & Wood Machine Co.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Smith & Winchester Mfg. Co.
Valley Iron Works
Warren Steam Pump Co.

**SUCTION BOXES**
Black-Clawson Company
Dowingtown Mfg. Co.
E. D. Jones & Sons Co.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Trimbey Machine Co.

**SUCTION BOX COVERS**
Beloit Iron Works
Black-Clawson Company
E. D. Jones & Sons Co.
Moore & White Co.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.

**SUCTION ROLLS**
American Wringer Co.
Beloit Iron Works
Black-Clawson Company
Cincinnati Rubber Mfg. Co.
Downingtown Mfg. Co.
Stowe-Woodward, Inc.

**SULPHUR**
American Cyanamid & Chemical Corp.
Texas Gulf Sulphur Co.

**SULPHUR BURNERS**
Valley Iron Works

**SWITCHBOARDS**
General Electric Company

**TABLE ROLLS**
American Wringer Co.
Beloit Iron Works
Black-Clawson Company
Cincinnati Rubber Mfg. Co.
Rodney Hunt Machine Co.
The Sandy Hill Iron & Brass Works
Stowe-Woodward, Inc.

**TACHOMETERS**
The Bristol Co.
The Foxboro Company
Leeds & Northrup Company

**TANKS**
Hendrick Mfg. Co.
The Hauser-Stander Tank Co.
E. D. Jones & Sons Co.
Kalamazoo Tank & Silo Co.
The Manhattan Rubber Mfg. Co.
The Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc.
The Noble & Wood Machine Co.
J. O. Ross Engrg. Corp.
Waldron Corp., John

**TELEMETERS**
The Bristol Company
The Foxboro Company
Leeds & Northrup Co.

**TELETYPE MACHINES**
American Tel. & Tel. Co.

**TENSILE TESTERS**
Perkins & Son, Inc., B. F.

**TESTERS (Bursting Strength)**
Perkins & Son, Inc., B. F.
Merrick Scale Mfg. Co.

**TESTERS (pH)**
Leeds & Northrup Company
Wallace & Tiernan Co., Inc.

**TESTING LABORATORY**
E. I. du Pont de Nemours & Co., Inc.

**THICKENERS**
Bird Machine Company
Dorr Co.
Downingtown Mfg. Co.
Moore & White Co.
D. J. Murray Mfg. Co.
Oliver United Filters, Inc.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.

**TITANIUM PIGMENT**
Chemical & Pigment Co.
Titanium Pigment Co.
United Color & Pigment Co.
R. T. Vanderbilt Co.

**TIE RODS**
International Nickel Co.

**TOILET FOLDING MACHINES**
Hudson Sharp Machine Co.
Paper Converting Machine Co., Inc.

**TOWEL FOLDING & INTERFOLDING MACHINES**
Dietz Machine Works
Hudson Sharp Machine Co.
Paper Converting Mch. Co.
Waldron Corp., John

**TOWEL WINDER**
Cameron Machine Co.
Dietz Machine Works
Hudson Sharp Machine Co.
Paper Converting Mch. Co.
Waldron Corp., John

**TOWERS**
Cameron Machine Co.
Hudson Sharp Machine Co.
Waldron Corp., John

**TRANSFORMERS**
General Electric Company

**TRANSMISSION MACHINERY**
Appleton Machine Co.
Beloit Iron Works
Black-Clawson Company
De Laval Steam Turbine Co.
Farrel-Birmingham Co.
Link-Belt Co.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Timken Roller Bearing Co.

**TRAPS (Steam)**
Crane Co.
Grinnell Company
Shartle Bros. Mch. Co.
Stickles Steam Specialties Co.

**TRUCKS**
Baker-Raulang Co.
Elwell-Parker Electric Co.
Moore & White Co.
Towmotor Company

**TUBES (Paper)**
Elixman Paper Core Co.
Sonoco Products Co.

**TUBING**
Chase Brass & Copper Co.
The International Nickel Co.
Timken Roller Bearing Co.

**TUBS**
De Laval Steam Turbine Co.
Rodney Hunt Machine Co.
The Noble & Wood Mch. Co.

**TURBINES**
General Electric Company

**TURBINES (Water)**
De Laval Steam Turbine Co.
Rodney Hunt Machine Co.

**TURBO-GENERATORS**
De Laval Steam Turbine Co.
General Electric Company

**USED EQUIPMENT**
Consolidated Products Co., Inc.
Gibbs-Brower Co.
Davis, Frank H. Co.
Mansel L. Rankin
The Noble & Wood Machine Co.
Shartle Brothers Machine Co.

**VALVES**
The Bristol Company
Crane Co.
The Foxboro Company
E. D. Jones & Sons Co.
Mason-Neilan Regulator Co.
D. J. Murray Mfg. Co.
The Noble & Wood Machine Co.
Record Foundry & Machine Co.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Taylor Instrument Companies
Trimbey Machine Works

**VENTILATING SYSTEMS**
Perfecting Service Corp.
J. O. Ross Engrg. Corp.

**VULCANIZERS**
H. H. Heinrich, Inc.

**WASHERS**
Bird Machine Company
Downingtown Mfg. Co.
E. D. Jones & Sons Co.
Moore & White Co.
The Noble & Wood Machine Co.
The Sandy Hill Iron & Brass Works
Oliver United Filters, Inc.
Rodney Hunt Machine Co.

**WATER SUPPLY & CONTROL**
Johnson & Wierk, Inc.

**WATER WHEELS**
Rodney Hunt Machine Co.

**WAXING MACHINERY**
Beloit Iron Works
Black Clawson Co.
Potdevin Machine Co.
Shartle Brothers Machine Co.
Waldron, John, Corp.
Weber, Herman G.

**WAX SIZE**
American Cyanamid & Chemical Corp.
Paper Makers Chemical Division, Hercules Powder Co.
Reichhold Chemicals, Inc.

**WEIGHING MACHINES (Automatic)**
Merrick Scale Mfg. Co.

**WELDING**
Grinnell Company

**WELDING EQUIPMENT (Electric)**
General Electric Company

**WHEATSTONE BRIDGES**
Leeds & Northrup Company

**WET MACHINES**
Bagley & Sewall Mfg. Co.
Beloit Iron Works
Black-Clawson Co.
Downingtown Mfg. Co.
Improved Paper Mchy. Corp.
Moore & White Co.
Montague Machine Co.
The Noble & Wood Machine Co.
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Smith & Winchester Mfg. Co.
Valley Iron Works

**WHITE WATER**
Johnson & Wierck, Inc.

**WINDERS & REWINDERS**
Bagley & Sewall Mfg. Co.
Beloit Iron Works
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Cameron Machine Co.
Davis, Frank H., Co.
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John Waldron Corp.

**WIRES**
Appleton Wire Works
International Wire Works
Lindsay Wire Weaving Co.

**WIRE AND CABLE (Electric)**
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**WIRE CLOTH**
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International Nickel Co.

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**WIRE STRETCH ROLLS**
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Stowe-Woodward, Inc.
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**WOOD TANKS**
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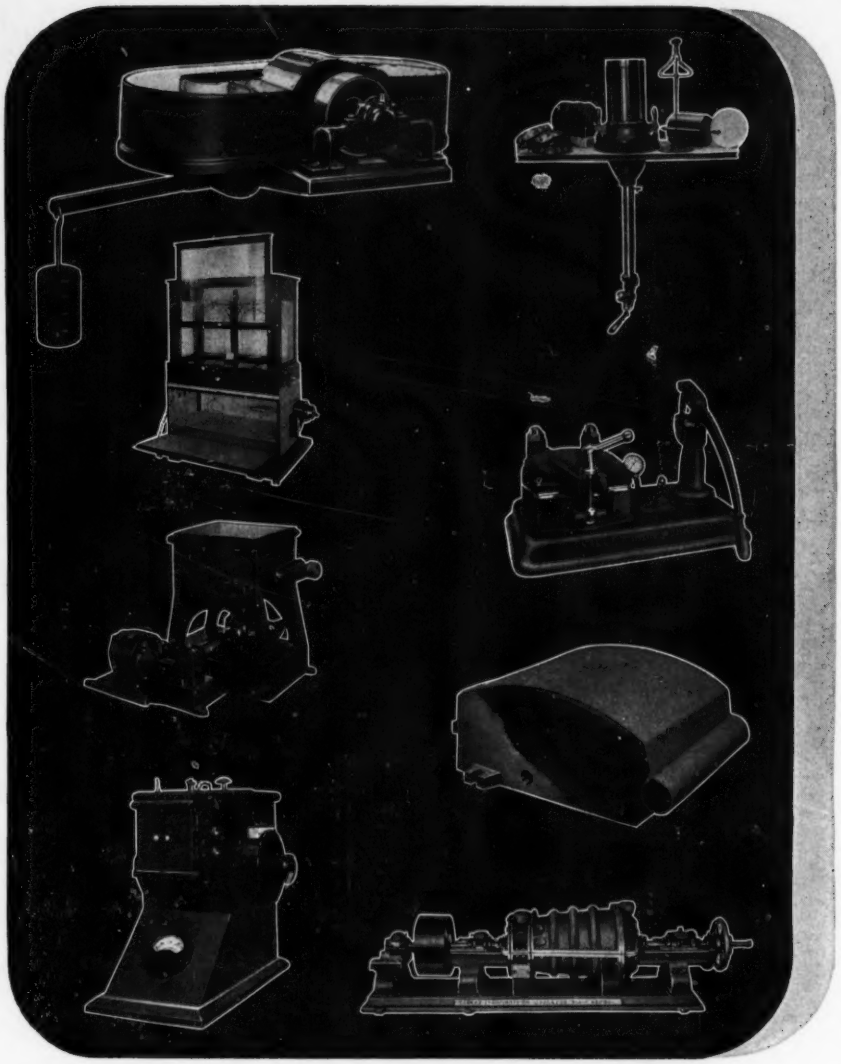

# "VALLEY" LABORATORY EQUIPMENT

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